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## THE VALUE OF LIPIODOL IN THE DIAGNOSIS AND TREATMENT OF ABSCESS OF THE LUNG


BY HARRY C. BALLON, M.D., MONTREAL, QUEBEC


A VERY extensive literature on abscess of the lung, including accurate descriptions of the clinical picture as well as the various methods for the experimental production of this form of lung suppuration, already exists. Since the introduction of pneumonographic methods by Jackson (5) and Lynah (6) and particularly with the injection of lipiodol as carried out by Sicard and Forestier (7), David H. Ballon (2) and others, a definite attempt at a better understanding of the underlying lesions of the various lung suppurations has been made. The result has been that our views on the diagnosis and treatment of abscess of the lung have been somewhat altered. We feel that the value of lipiodol lies in the fact that it affords in most cases a means of demonstrating the extent of the underlying pathological process, of estimating the response to treatment, and of observing whether the treatment has completely accomplished its task.

In the records of the Surgical Service of the Royal Victoria Hospital, for the past 16 years, there were 94 cases of abscess of the lung. It is my purpose to summarize these records briefly in order to present these experiences. Many of the details have received but scant attention, an attempt being made rather to explain past errors in the diagnosis and treatment on the basis of information obtained from a routine examination, which included preliminary and postoperative injection with lipiodol.

The youngest age recorded among females in this series was 1 year, while in the males it was 2 years, the latter being a true postpneumonic abscess of the lung (Table I). It

TABLE I.—AGE INCIDENCE, SEX, AND MORTALITY—94 CASES

| Age | Females | Deaths Females | Males | Deaths Males |
|---|---|---|---|---|
| Under 5 | 2 | 1 | 2 | .. |
| 5 to 10 | 1 | .. | 1 | .. |
| 10 to 20 | 2 | .. | 7 | 1 |
| 20 to 30 | 13 | 2 | 10 | 1 |
| 30 to 40 | 7 | 4 | 20 | 9 |
| 40 to 50 | 4 | 1 | 11 | 2 |
| 50 to 60 | .. | .. | 9 | 2 |
| 60 to 70 | 1 | .. | 2 | 2 |
| No record of age | 2 | 1 | .. | .. |
| Total | 32 | 9 | 62 | 17 |

is interesting to note that the degree of severity and number of cases recorded did not seem to be influenced by the virulence of the respiratory infection during influenza epidemics.

With regard to predisposing factors and etiology, nothing more than a classification of the apparent direct cause has been made (Table II).

Of the 94 cases here recorded, a relatively high percentage (25 per cent) occurred in patients who had operations about the mouth and throat. In this connection it is important to appreciate that the occurrence of a febrile disease with cough and fetid expectoration fol-

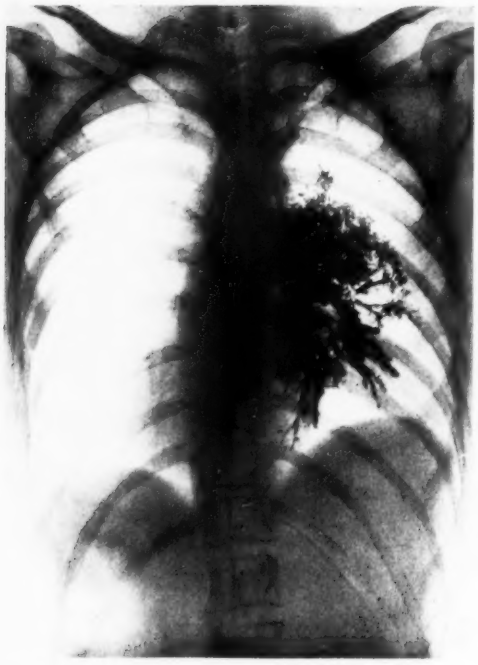

Fig. 1. Case 1. Bronchiectasis in the right middle and lower lobes in a female aged 54, a patient of Dr. E. A. Archibald. She developed a febrile disease with cough and fetid expectoration 3 weeks after the extraction of teeth. In the absence of a history of previous respiratory infection, a diagnosis of lung abscess had been made. A lipiodol injection was carried out by Dr. David H. Ballon. Roentgen film by Dr. A. H. Pirie.

lowing immediately upon an operation in a patient who had no previous respiratory infection, is not necessarily sufficient to make a diagnosis of abscess of the lung. Figure 1 represents a case of which we have several parallels and which will serve as an example.

Concerning the clinical history of the illness, nothing can be added that is new. Cough of a productive nature, often blood stained with fetor, fever, chills, sweats, and chest pain, as well as loss of strength and appetite, would appear to be the most common symptoms in order of frequency. In an acute case the patient is quite often able to indicate the site of disease by the location of the pain. Constipation appears to be the rule, while diarrhœa, presumably of toxic causation, was usually found to be a bad prognostic

Fig. 2. Case 2. Bronchiectasis in the left lower lobe in a patient of Dr. David H. Ballon, injected bronchoscopically by him. Prior to injection this patient had been treated for pulmonary tuberculosis.

TABLE II.—CAUSE

| | Cases |
|---|---|
| Operations about the mouth | |
| Plastic on nose and mouth | 1 |
| Tonsillectomy | 8 |
| Extraction of teeth | *11 |
| Operations elsewhere | |
| Hæmorrhoidectomy | 2 |
| Cholecystectomy | 1 |
| Gastro-enterostomy | 3 |
| Hysterectomy | 1 |
| Trauma | 1 |
| Respiratory infections | |
| Bronchitis | 7 |
| Influenza | 14 |
| Lobar pneumonia | 15 |
| Bronchopneumonia | 11 |
| Repeated "colds" | 10 |
| New-growth | 1 |
| Cause uncertain | 8 |
| | 94 |

*One case done under local anæsthesia.

sign and was frequently accompanied by evidence of involvement of the kidneys and the serous cavities.

The blood picture showed a leucocyte count varying from 6,000 to 38,000. Anæmia was frequently found and varied with the degree of suppuration, and period of the disease. Sputum examinations as often as not failed to show elastic tissue.

The onset was usually with constitutional symptoms. The abscess remained closed from

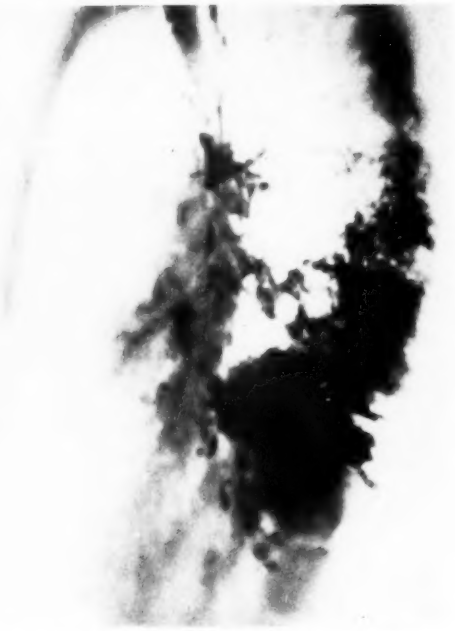

Fig. 3. Case 3. Bronchiectatic abscesses with bronchiectasis (lateral view), in both lower lobes, in a boy aged 13, a patient of Dr. Roddick Byers. These cavities required 50 cubic centimeters of lipiodol to fill them. Lipiodol injection by Dr. David H. Ballon. Roentgen film by Dr. A. H. Pirie.

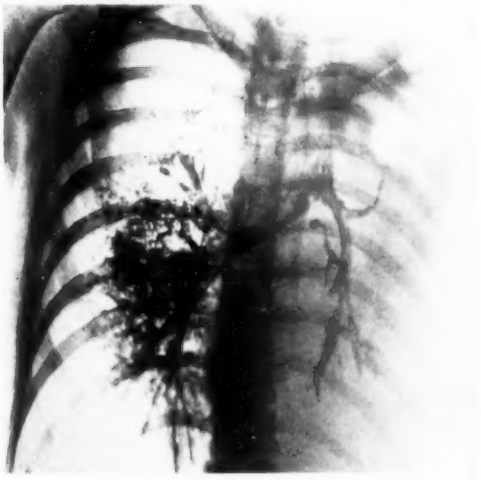

Fig. 4. Case 4: Pulmonary tuberculosis with bronchiectasis in right lung. Roentgenogram after lipiodol injection showed a normal bronchial tree in the left lung where bronchiectasis was previously suspected. Note the scoliosis, approximation of the ribs on the affected side, acentrally placed trachea, and apparent redundancy of the right lower main stem bronchus.

a few days to a few weeks when foul expectoration made its appearance. In chronic cases in which the etiological factor was indefinite and the clinical picture obscure, the patients often presented a history of repeated upper and lower respiratory infections. They were of poor nutrition usually with thin flat chests, and too often seeking operative interference when they had become extremely poor operative risks. Clubbing of fingers was noted frequently among this type. No case of true spirillum infection was recorded, but thorough bacteriological investigation was often wanting. In a large percentage of those cases that did well the history was clear cut, physical signs were well defined and definitely localized, while the ordinary roentgenogram confirmed the picture by demonstrating a cavity with fluid level.

Roentgenogram findings varied. One could not always depend on and hope for the presence of a cavity with fluid level to make a diagnosis. Abscesses situated in the periphery of the lung appeared to show a fluid level more often than those situated near the root of the lung, and were consequently more favorable for operation. Although the classical physical signs of cavity may be absent, one must demand some signs for localization, and not feel that in their absence ordinary roentgenograms are sufficient. Previous methods have been inadequate for making an accurate diagnosis in these cases. Such cases demand a more exact diagnosis if successful treatment is to be carried out. Fortunately, we have recently acquired a new means of diagnosis in lipiodol injection.

Since the introduction of lipiodol into radiology, with its application to lung mapping, our views on the pathological diagnosis and treatment have been somewhat altered. We have had the opportunity of seeing lipiodol used by the bronchoscopic method in a fairly large group of lung suppurations and have been impressed with the following facts:

1. That the ordinary X-ray *per se* in a great many instances gives an ill-defined anatomical

Fig. 5. Case 5. Pulmonary tuberculosis with bronchiectasis and abscess right, in a patient of Dr. E. A. Archibald. Note the marked displacement of the trachea, the extensive bronchiectasis with abscess formation, where ordinary roentgen-ray showed but a thickened pleura; 20 cubic centimeters of lipiodol was injected in this case by Dr. David H. Ballon, without ill effect.

localization of the site of disease and even a false impression of the extent of the disease which clinical examination may often fail to correct. An excellent example is seen in Figure 2, Case 2.

2. That localization of abscess of the lung, if one is to obtain better results and shorter hospitalization, must consist of as complete a definition as possible of the surrounding parenchyma and bronchial architecture. This is particularly true of the left chest behind the heart shadow and of the lung area below the dome of the diaphragm in which sites both ordinary roentgen films and clinical examination are apt to leave one uncertain (Fig. 3, Case 3).

3. That more attention must be given to the demonstration of the area of healthy tissue both on the affected and on the non-affected side, before operation (Fig. 4, Case 4; Fig. 5 Case 5).

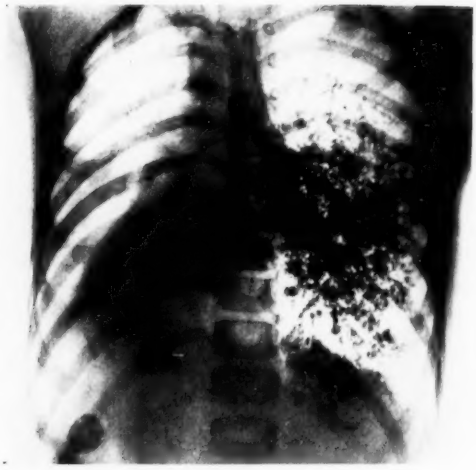

Fig. 6. Case 6. Abscess of the left lung, with bronchiectasis and empyema. Patient was a boy aged 12 years, in the service of Dr. E. A. Archibald. A bronchoscopic examination with lipiodol injection by Dr. David H. Ballon showed the left main stem bronchus to be stenosed. In the process of repair this stenosed bronchus became a dilated one.

4. That the condition of the upper and lower respiratory tract is of importance in obscure cases. Such cases, if possible, should receive preliminary bronchoscopic examination. The presence of stenosis, carcinoma, and foreign body can often be revealed only by this method. Direct smears and cultures should be taken whenever possible (Fig. 6, Case 6).

This really means that ill-defined chronic cases should be treated in large hospitals where adequate investigation and treatment can be obtained at the hands of the internist, radiologist, bronchoscopist, and surgeon. It is true that the ordinary clinical investigation should always come first, and that special investigation should come last, but one must always appreciate the fact that most affections of the thorax come into the realms of the specialist. Some of the poor results so far obtained are due not to faulty treatment but in a sense rather to incomplete diagnosis.

Our later results and observations lead us to believe that lipiodol is a valuable help not only in diagnosis but also in estimating the effect of treatment during the course of that treat-

ment and finally in estimating the ultimate results (Fig. 7, Case 7).

The use of this agent promises that better results in the treatment of lung abscess will be obtained only when before beginning treatment the complete extent of the pathological process is ascertained, the response to treatment thus judged and the treatment checked up to see if it has accomplished its task completely. This can perhaps be illustrated in the following manner. A patient with pulmonary tuberculosis who in the judgment of the sanitarium physician is a suitable case for thoracoplasty is sent to the thoracic surgeon. The roentgenogram reveals the usual picture, the old healed spot in the good lung, the apical cavity with indefinite detail, the results of pleural thickening and fibrosis as shown by contracted ribs, the displaced heart, and the raised and adherent diaphragm. Such a case is undoubtedly suitable for thoracoplasty. In this clinic, a more definite prognosis can be attempted in most instances as the result of the preliminary routine investigation which includes an injection of lipiodol by the bronchoscopic method. Thus the relation of a cavity to the hilus, the degree of associated bronchiectasis enables one to estimate the likelihood of the persistence of cough and expectoration. Further postoperative injection at a later date as illustrated by Archibald (1) will demonstrate the efficiency of collapse, and in those cases that have persistence of cough and expectoration will reveal the cause for their persistence. All cases of pulmonary tuberculosis are not suitable for such treatment, but we can see no contra-indication at the present time to making injections in those chronic ill-defined cases of abscess of the lung in which treatment promises to be difficult or doubtful and convalescence lengthy.

The following case report will perhaps serve as a more direct illustration, particularly as to the routine of investigation that has recently been adopted for chest cases in the surgical service of the Royal Victoria Hospital.

Male, age 17 years, student, was admitted to the hospital July 8, 1925, complaining of cough, mucopurulent expectoration (1 ounce plus per day) dyspnœa on exertion, and slight loss of weight (best

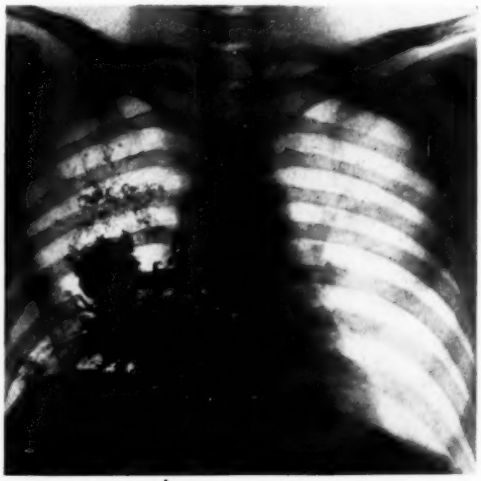

Fig. 7. Case 7. Abscess of the lung, right lower lobe, with bronchiectasis, in a patient of Dr. C. B. Keenan. This individual developed an abscess of the lung following a gastro-enterostomy for duodenal ulcer. The lipiodol injection illustrates how the injection may serve as an aid in estimating the effect of treatment. Twenty-five cubic centimeters of lipiodol was injected in this instance by Dr. D. H. Ballon. Roentgen film by Dr. A. H. Pirie.

weight 128, weight on admission 120 pounds), night sweats, and chilly sensations. Personal history is negative save for frequent epistaxis and head colds. The family history contains nothing bearing on present illness.

History of present illness is one of exposure to inclement weather on August 30, 1924, when the patient contracted a cold with cough followed shortly by mucopuru ent expectoration. He was not confined to bed, but was sent to the Laurentian Mountains, where he improved slightly. On January 30, 1925, he was admitted to the service of Dr. David H. Ballon for a tonsillectomy. Because of a sudden profuse expectoration of foul sputum on the night of admission the patient was referred to Dr. Roddick Byers. Examination of the chest revealed signs at the left base suggestive of localized interlobar empyema. The fluoroscopic examination showed the heart shadow to blend with an indefinite shadow that made the heart look very large. Sputum analysis at the time showed non-odorous, yellowish grey, almost pure polymorphonuclear pus with diplococci in chains both intracellular and free. No acid fast bacilli could be found, some elastic tissue was present. On July 7, Dr. Byers performed a thoracentesis, obtaining pus in the tenth interspace 3½ inches from the spine and at a depth of 2 inches. The patient was then admitted to the service of Dr. E. W. Archibald on the following day. Dr. Pirie's X-ray report stated that there was a dense area at the base of the left lung but that no definite fluid

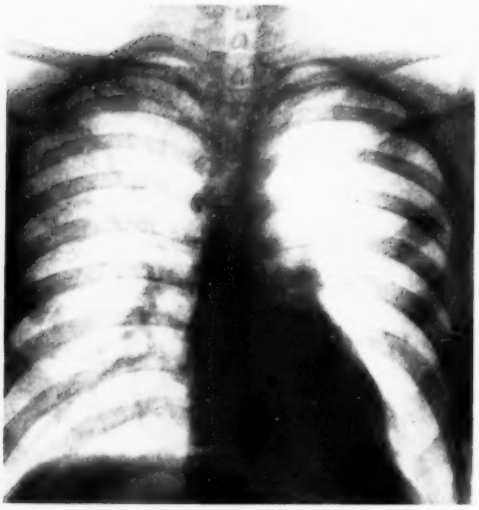

Fig. 8. Case 8. Abscess of the lung with bronchiectasis in the left lower lobe. Note the silver clips marking off the site of operation behind the heart shadow, and the absence of detail in this case.

level could be obtained, the appearance suggesting a localized empyema. A bronchoscopic examination was carried out by Dr. David H. Ballon, who found pus and bleeding granulations in the left lower bronchus. Because of active bleeding, lipiodol was not injected on this occasion. On July 11, with a pre-operative diagnosis of lung abscess, the eighth and ninth ribs were resected by Dr. Archibald close to the spine under local anæsthesia. A non-adherent pleura being demonstrated by the pneumothorax needle, the whole bed was packed with iodoform gauze. Five days later the lung was entered with the actual cautery and a cavity found which contained 4 drams of thick creamy pus. A second small abscess cavity was discovered leading to the first. The lung tissue when palpated felt diffusely

Fig. 10. Case 8. Injection of the open bronchi through wound in the same case as in Figures 8 and 9 to show the associated bronchiectasis behind the heart shadow.

Fig. 9. Case 8 (same patient as Fig. 8, Case 8). Plate taken following the injection of 25 cubic centimeters of lipiodol. This case illustrates chronic abscess of the lung associated with bronchiectasis when expectoration is but overflow. They show no fluid level and on injection the abscess area casts no shadow. Note the position of clips with reference to mouth of cavity.

Fig. 11. Case 8. A case of lung abscess of the narrow neck type which does not show a fluid level, and which is associated with bronchiectasis. Roentgenogram after lipiodol injection made at time of discharge showing healthy tissue outside area of operation. The bronchus was dry and healthy and the whole area of disease had been thoroughly eradicated. Patient was now free of signs and symptoms.

Fig. 12. Case 9. Abscess of the lung in a male aged 18, patient of Dr. E. A. Archibald. Bronchoscopic examination and lipiodol injection by Dr. David H. Ballon revealed a small area which did not fill. Ordinary roentgen-ray in this instance shows no fluid level. Roentgen film by Dr. A. H. Pirie.

Fig. 13. Case 3. Bronchiectatic abscess with bronchiectasis. Lateral view.

firm but not obviously marshy. The patient was discharged on August 9, improved, there being moderate discharge from the sinus and a slight cough with expectoration. He was readmitted on September 26 because of the persistence of symptoms and a bronchoscopic examination with lipiodol injection was performed under local anæsthesia by Dr. David H. Ballon. The technique that was employed has been described elsewhere (3). Considerable pus was noted coming from the left lower lobe, the bronchus appeared widely dilated, and the mucous membrane inflamed and covered with bleeding granulation. After aspiration when cultures were taken, 20 cubic centimeters of lipiodol was injected, and plates taken in various positions at intervals (Figs. 8 and 9, Case 8). The injection revealed a "silent" area, such as one sees in a case of a pyelogram for renal tumor. The open bronchi were then injected with lipiodol through the wound, the site of the operation having been marked off by silver clips by Dr. Archibald at the time of operation, and revealed an extensive associated bronchiectasis behind the heart shadow (Fig. 10, Case 8). This was, therefore, a case of lung abscess of the narrow neck type that does not show a fluid level, and which is associated with bronchiectasis. Dr. Archibald then continued cauterization with the electrocoagulation needle, until at the time of discharge the patient was free of symptoms, and a further bronchoscopic examination and lipiodol injection revealed a healthy dry bronchus and showed that the whole area of disease had been thoroughly eradicated (Fig. 11, Case 8).

There will always be some cases which, because of extreme stenosis or angulation of the bronchus, cannot be successfully injected with lipiodol before operation, but if no gas or pus is obtained at operation and one is thus left in doubt as to the actual existence of the abscess, one can later take advantage of the open wound in the lung, and inject lipiodol from the outside for further detail. It will not be long, as has been illustrated in three cases, before a stenosed bronchus will become a dilated one, as the presence of open bronchi readily leads to the development of an associated bronchiectasis.

It is not enough to assume the presence of an associated bronchiectasis in those patients in whom the physical signs or roentgen-ray

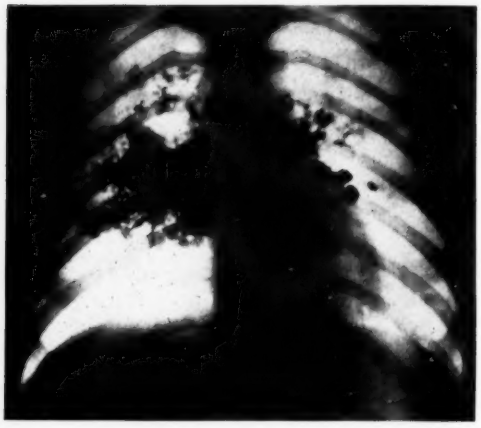

Fig. 14. Case 10. Multiple lung abscess with bronchiectasis left in a patient of Dr. D. H. Ballon; 25 cubic centimeters of lipiodol was injected in this instance.

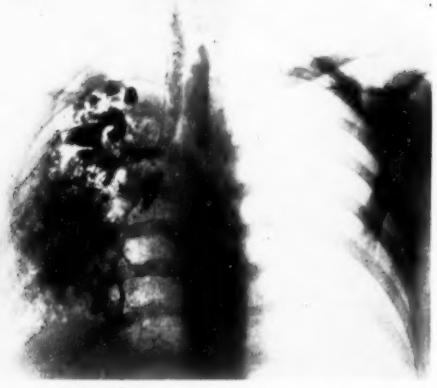

Fig. 15. Case 11. Tuberculous abscess with bronchiectasis in a patient of Dr. E. A. Archibald. Injection by Dr. David H. Ballon. Roentgen film by Dr. A. H. Pirie.

films suggest something more than an abscess, or who do not progress well after operation. It is doubtless true, and accords with our experience, that abscess of the lung in a great many instances is complicated by some degree of bronchiectasis. A lipiodol injection can now afford more accurate information, and it is one's duty whenever possible to prove the presence and extent of associated bronchiectasis by this means before undertaking any radical procedure. Only so can the whole task to be accomplished be visualized. Investigation has also taught us that in the process of repair, particularly in cases of abscess of the lung that do not drain well, bronchiectatic dilatations may develop and persist.

A marked chronic inflammatory wall surrounding an abscess cavity points to a somewhat reduced chance of spontaneous closure after free drainage. In a great many such cases the abscess cavity contains much grumus material, fibrin, and mucus. Such a type of cavity content is responsible for persistent fetid expectoration, and it would appear that many of them are of the narrow-necked type where expectoration is but overflow, so that they do not show a fluid level and are not amenable to direct aspiration by the bronchoscope. These are difficult to inject with lipiodol, the lung area containing the cavity remaining as a blank.

Abscesses of the lung may be acute or chronic, single or multiple. When the roentgen-ray film fails to show a cavity with fluid level, one should be suspicious of something more than a circumscribed local abscess of the lung. I therefore offer a classification of abscess of the lung, the result of studies after injection with lipiodol which will show that many of those ill-defined cases are associated with some degree of bronchiectasis.

In this series of 94 patients admitted, 88 received treatment. Of these 88, 70 were treated by rib resection and tube drainage, 12 of which were cured. Five were treated by pneumothorax, 2 were cured and the other 3 definitely improved. In one case treated by open pneumothorax and drainage the patient succumbed because of general infection. Eight patients were treated by rib resection and cauterization, the electrocoagulation needle being employed in four; these latter ones were among those that had received preliminary investigation as already illustrated. One felt that on their discharge three of these patients could be considered as cured with fair certainty. The electrocoagulation needle is a definite aid in that it can be employed at frequent intervals, requires no preparation on the part of the patient, and produces no untoward reaction. The persistence of any cough or expectoration is in many instances

TABLE III.—CLASSIFICATION OF ABSCESS OF THE LUNG

I. Solitary
   a. With fluid level (Fig. 12, Case 9). This type of abscess is demonstrable by ordinary roentgen-ray.
   b. Large bronchiectatic abscess (Fig. 13, Case 3), acute or chronic. This type of abscess may be aspirated and will inject with lipiodol. They may often be bilateral and are at times associated with some other phase of bronchiectasis.
   c. Associated with bronchiectasis (Ref. Figs 9, 10, Case 8), chronic. This is of the narrow neck type in which expectoration is but overflow. They show no fluid level and on injection the abscess area casts no shadow.

II. Multiple
   a. Multiple lung abscess (Fig. 14, Case 10), chronic, which may be associated with bronchiectasis.

III. Secondary. Those due to tumor and foreign body (4).

IV. Tuberculous. This type may be associated with bronchiectasis (Fig. 15, Case 11), acute or chronic.

Metastatic lung abscess and cyst degeneration are not considered in this classification.

TABLE IV.—RESULTS OF TREATMENT OF ABSCESS OF THE LUNG[1]

| Method | No. of Cases | Cured | Imp. | Not Imp. | Died |
|---|---|---|---|---|---|
| Tube and drainage | 70 | 12 | 31 | 4 | 23 |
| Pneumothorax | 5 | 2 | 3 | .. | .. |
| Pneumothorax and drainage | 1 | .. | .. | .. | 1 |
| Resection and cauterization | | | | | |
| a. Actual cautery | 4 | 2 | 1 | .. | 1 |
| b. Electrocoagulation needle | 4 | 3 | 1 | .. | .. |
| Partial extrapleural thoracoplasty | 1 | 1 | .. | .. | .. |
| Rupture into bronchus | 1 | 1 | .. | .. | .. |
| Cauterization and drainage of lobe brought outside chest wall | 1 | .. | .. | .. | 1 |
| Permanent fistula | 1 | .. | 1 | .. | .. |
| Total | 88 | 21 | 37 | 4 | 26 |
| Per cent | .. | 24 | 42 | 5 | 29 |

[1] Of a total of 94 cases, 88 were treated.

due to the presence of associated bronchitis or a slight degree of bronchiectasis which has resulted in the process of repair.

Partial extrapleural thoracoplasty was performed in one instance, a multiple abscess of the lung involving the right upper lobe. Because of its position as demonstrated by injection with lipiodol, it was ideally suited for treatment by collapse, as the lower lobe was found to be healthy and free. This patient was discharged cured after a stay of 17 days in the hospital. On admission she had raised an average of three sputum boxes full per day, on discharge expectoration was less than a dram. One case of spontaneous rupture into the bronchus with complete relief was recorded in this series; while in one case of lung abscess involving the left upper lobe, treatment by permanent fistula has been observed for a period of 13 years, and has been free from cough and expectoration. The sinus still requires daily dressing (Table IV).

In many of the chronic cases of abscess of the lung, the simple drainage procedure as noted often fails to cure. The period of treatment in the hospital will be at least 6 weeks, while the period of incapacity as to occupation must usually last 6 months or more.

Fifteen patients admitted with a diagnosis of abscess of the lung have been injected with lipiodol. In but one instance was there a solitary abscess of the lung, which proved to be the only occasion that ordinary roentgen-ray suggested a cavity with fluid level. One other revealed multiple abscesses in the right upper lobe, to which reference has already been made. Eight injections revealed abscess of the lung associated with fairly extensive bronchiectasis, which in one case was bilateral. Pure bronchiectasis was noted twice, as was putrid bronchitis which was free of bronchiectasis. The remaining one proved to be a primary carcinoma of the bronchus. Operation in nine and necropsy in one showed that localization had been accurate.

Necropsy was performed in 16 of the 26 fatal cases. Six of these cases showed extensive bronchiectasis, three were pulmonary tuberculosis with abscess, while death was caused in two cases by complicating brain abscess. In one instance extensive gangrene with rupture of a large vessel in the area of gangrene was responsible for the final issue. Two other patients developed terminal empyema probably due to pleural tears. One of them also developed a phlegmon of the chest wall.

It is noteworthy that in 14 of the patients who died, there were repeated operations, each of which either failed to find the actual site of disease or did so incompletely. Two of the patients had previously been discharged as cured.

SUMMARY

1. A review of 94 cases of abscess of the lung is presented. A relatively high percentage (25 per cent) occurred following operations about the mouth and throat.

2. Errors in diagnosis based on the so-called typical history are illustrated.

3. The relative infrequency of a demonstrable cavity with fluid level by the ordinary X-ray in chronic abscess of the lung is noted.

4. The use of lipiodol by the bronchoscopic method when combined with a definite routine examination is of undoubted value. No reactions from the use of this agent in this form of lung suppuration have been noted.

5. Ordinary X-ray *per se* in many instances gave an ill-defined anatomical localization of the site of disease and even a false impression of the extent of disease which clinical examination often failed to correct.

6. Shorter hospitalization and better results will be obtained when the surrounding parenchyma and bronchial architecture are completely defined; particularly in relation to the left chest behind the heart shadow, of the lung area below the dome of the diaphragm, and in relation to ill-defined diaphragmatic shadows.

7. Healthy tissue on the non-affected as well as on the affected side should be demonstrated before extensive operative procedure is commenced. The condition of the upper and lower respiratory tracts is of importance in obscure cases.

8. The treatment of ill-defined cases in a well-equipped hospital is advocated.

9. The results of treatment should be checked up from time to time until no symptoms persist that cannot be adequately explained.

10. The use of the electrocoagulation needle is an aid in certain cases.

11. A classification of abscess of the lung is presented.

12. Abscess of the lung in this series was found to be frequently associated with bronchiectasis.

13. Bronchial dilatations may develop during the process of repair and may persist.

14. Repeated operations should not be undertaken on obscure cases without a definite diagnosis.

15. Positive shadows demonstrated by injection with lipiodol, which were associated with signs and symptoms, were proven to be trustworthy.

The material comprising this study has been obtained from the records of the Surgical Service of the Royal Victoria Hospital. The majority of these cases were in the service of Dr. E. A. Archibald, to whom I am indebted for permission to use the material and for aid and suggestions in the preparation of this report.

REFERENCES

1. Archibald, Edward. X-ray demonstration of pulmonary changes in tuberculosis by lipiodol injection. Canad. M. Ass. J., 1925, xv, 1000–1002.
2. Ballon, David H. Lipiodol in the diagnosis of broncho-pulmonary lesions by the bronchoscopic method, report of fifty cases. Arch. Otolaryngol., 1926, iii, 403–422.
3. Idem. The injection of lipiodol as an aid in the X-ray diagnosis of broncho-pulmonary lesions including tuberculosis, preliminary report. Canad. M. Ass. J., 1925, xv, 995–999.
4. Idem. Primary carcinoma of the bronchus with abscess of the lung diagnosed bronchoscopically and injected with lipiodol. (To be published.)
5. Jackson, Chevalier. The bronchial tree, its study by insufflation of opaque substances in the living. J. Roentgenol., 1918, v, 454.
6. Lynah, H. L. Lung mapping by the injection of bismuth mixtures in the living. Tr. Am. Laryngol. Ass., 1920, May.
7. Sicard and Forestier. Soc. méd. d. hôp., Paris, 1922, March 17.

# THE USE OF IODIZED OIL IN THE DEMONSTRATION OF EMPYEMA CAVITIES AND FISTULOUS TRACTS[1]

By JOHN D. LAWSON, M.D., Woodland, California
From the Department of Radiology, Woodland Clinic

THE present use of iodized oil in roentgenological diagnosis is the result of a coincidence of the kind which happens so frequently in medicine. In the latter part of the nineteenth and the early part of the present century the medical profession was using iodine in many forms and in many ways in the treatment of syphilis. It was given by mouth, per rectum, subcutaneously, intramuscularly, and intravenously.

In attempting to produce a substance which would give good absorption of a large amount of iodine when injected intramuscularly, Lafay of Paris used a mixture of iodine and oil of the field poppy. The iodine is disguised in this combination, although it is present to the extent of about 40 per cent, producing an oily fluid of heavy density. The rapidity of absorption was then checked by the X-ray, much the same as is done in the present experiments with the new bismuth preparations. There was no question of diagnosis as only the rate of absorption of the iodine in this type of solution was under investigation at that time.

However, in 1921 and 1922, Sicard and Forestier, noting the heavy density and consequent radiopacity as well as the non-irritant effects of lipiodol, as this solution was called, began investigating the possibilities of using this agent in diagnosis. Their first studies concerned the injection of lipiodol into the epidural space and were rapidly followed by the use of the solution in the study of the bronchopulmonary tree.

Subsequent investigations by these two men and other workers have comprised studies of the urethra, bladder, ureters and kidney pelves, vas deferentia, seminal vesicles, and in fact the entire hollow portion of the genitourinary tract, as well as the cerebrospinal fluid system, including the ventricles and the entire subarachnoidal space. Probably the most extensive work has been done on lung diseases, notably bronchiectasis and pulmonary abscess. In the literature no reports of deleterious results are noted which might be attributed to either the iodine or the oil, or both combined. Such complications as have been reported would probably have resulted from the use of any other fluid by the same technique.

Bearing in mind these facts we began a systematic investigation of all fistulous tracts at the Woodland Clinic about the middle of 1915. This type of work has not been described in the literature, although it is such a rational procedure that no doubt many of you have already adopted it in your own laboratories. However, I feel that it is of sufficient importance in roentgen diagnosis to be called to the attention of the profession in general with a view to its more common use as a diagnostic procedure.

Most of our work has been done on empyema as we have had a rather unusual number of cases of empyema following lobar pneumonia during the past year. They were rather fulminating in type, occurring generally within 3 to 5 days following the primary lung lesion.

Both closed and open methods of drainage were used in various cases, in which surgical procedures we are not interested for the purposes of this paper.

The value of iodized oil as a diagnostic method makes itself apparent when the surgeon requests information as to size, extent, and shape of the empyema cavity. This can be very definitely outlined for him by the injection, aseptically, of the oily solution into the fistulous tract having its opening formed by the original drainage tube. We note that often though a cavity is visualized on the flat plate and appears to be well drained, there is a pocket below the site of the tube which accounts for the continued fever, septic condition, and failure to recover. Frequently

[1] Read before the meeting of the Canadian Radiological Society and the Pacific Coast X-Ray Society, Victoria, B. C., June 21–25, 1926.

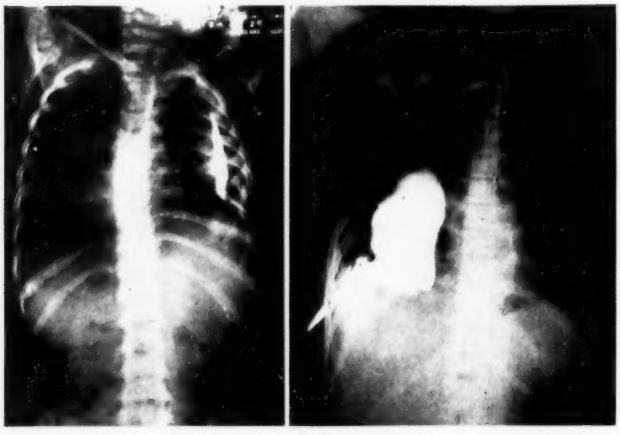

Fig. 1 (left). Typical empyema cavity with dependent drainage but stenosis of outlet.
Fig. 2. Large empyema cavity with cicatrization of sinus.

we find that the outlet of the empyema cavity has been stenosed by cicatricial tissue beyond the limits of the tube to such an extent that free drainage is impossible. In many cases we have found that the empyema was drained at its most dependent portion, only to have the lower part of the cavity obliterated by expansion of the lung with a resultant long, narrow sinus formed by the pleura, incompletely draining this remaining cavity. In these cases the flat chest plate or even stereoscopic films will not give the information desired, while one glimpse after injection by lipiodol will answer the question.

We also have to deal with cavities which are in the pleural space, yet below the dome of the liver. These cannot be visualized at all by ordinary means and yet are brilliantly demonstrated by the density of this solution.

There are many other fistulous tracts which we are called upon to investigate, and frequently we are requested by the surgeon to note the extent and ramification of an ischiorectal sinus. Many of these lead for a considerable distance past the sphincter, and the type of surgery depends to a large extent upon the course and distribution of the tract.

Tuberculous sinuses can be injected and connection with bone lesions proved or disproved. Very frequently this question arises inasmuch as a bone, underlying a tuberculous sinus, may indicate questionable or only very slight tuberculous infection. Visualization of the tract may prove that the bone is not a part of the discharging sinus and has no connection with it.

Postoperative abdominal fistulæ may be localized to a very accurate degree and the exact point of their connection, or lack of connection, with the gastro-intestinal tract may be discovered by this means. Gunshot wounds followed by a long period of suppuration may have the origin of their suppuration at the bottom of the fistulous tract, and the course of this sinus can readily be determined. In fact, any type of sinus which has an opening to the exterior can be investigated by these measures and much information obtained through this injection which could not be acquired in any other way.

To be sure, we have had Beck's paste, various types of suspensions of barium and bismuth for use in this particular phase of our work, but with marked disadvantages. Also the various iodide and bromide solutions have been used, but their very irritating effects on tissues limit their use to such a degree that they must be restricted to selected cases.

At the beginning of this paper I mentioned lipiodol and its derivation. This was not meant to convey the idea that lipiodol is the only or even the preferable type of iodized oil. It was the original, and only recently have certain American pharmaceutical houses placed on the market similar satisfactory solutions. All of them embody the one principle of a solution of iodine in a vegetable oil, formed in such a way that the iodine has not its usual irritating effects upon body tissue. The degree of efficiency of each of these substances varies directly with the proportion of iodine present.

Fig. 3. Long narrow sinus blocking drainage of cavity.

It has been my experience that it is not necessary in all cases to use the full strength solution as manufactured. The size, depth, and location of the area injected governs this particular procedure. In chest work above the diaphragm we have found that if a 20 per cent content of iodine is present, the shadow is relatively as dense as that produced by a more concentrated solution. For that reason it has been our custom to dilute the iodized oil with pure olive oil down to 20 per cent iodine content. This in no way interferes with the solution. However, if it is allowed to stand for any length of time, is exposed to the air, or is sterilized in the autoclave, a portion of the iodine is precipitated and the solution is rendered unfit for use. Hence the diluting is done at the time of injection and any remainder discarded.

In the injection of all cavities aseptic technique must of course be used. A patient should be observed rather closely to prevent overdistention and the possible rupture of a walled-off inflammatory process, which accident might result in the dissemination of infection.

The procedure is absolutely painless to the patient and I have as yet to hear any complaint.

The shadow may remain present for weeks or even months. Symptoms of iodism have never appeared in any patients of our series although as much as 50 grams of iodine have been injected at one time.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 4. Irregular burrowing ischiorectal fistula.
Fig. 5. Large sinus following anterior nephrectomy of tuberculous kidney.
Fig. 6. Roentgenogram showing an irregular sinus in a perinephritic area following septicæmia and perinephritic abscess.

BIBLIOGRAPHY

Editorial. Iodized oil in roentgenology. Am. J. Roentgenol., 1926, xv, 352.

Forestier, J. Roentgenological exploration of the bronchial tubes with iodized oil. Radiology, 1926, vi, 303.

Idem. Iodized oil in radiological practice. Paris méd., 1924, April 26, p. 377-383.

Forestier and Leroux. Intratracheal injections. Paris méd., 1922, xii, 403.

Idem. Radiographic study of intratracheal injections of iodized oil. Bull. et mém. Soc. méd. d. hôp. de Par., 1923, xlvii, 299-304.

Idem. Technique for intratracheal injections of lungs. Progrès méd., 1923, xxxviii, 251.

Idem. Intratracheal injection of iodized oil. Semana med., 1923, i, 1228.

Idem. Intratracheal injections of iodized oil in examination of bronchi. J. de radiol. et d'électrol., 1923, vii, 351.

Forestier and Sicard. Iodized oil in roentgenography of urethra. Bull. et mém. Soc. méd. d. hôp. de Par., 1924, xlviii, 207.

Idem. Iodized oil for contrast in roentgenology. Presse méd., 1923, xxxi, 493.

Idem. Iodized oil as contrast medium in roentgenology. Bull. et mém. Soc. méd. d. hôp. de Par., 1922, xlvi, 463.

Saralegui, J. A. Iodized oil as contrast suspension in radiological exploration of urinary tract. Rev. Asoc. méd. argent., 1924, xxxvii, 270.

Schmidt, E. A. The use of iodized oil in the roentgen-ray diagnosis of spinal lesions. Am. J. Roentgenol., 1926, xv, 431.

# AN EXPERIMENTAL STUDY OF THE LYMPHATIC THEORY OF PANCREATITIS[1]

By MARK KAUFMANN, M.D., C.M., Montreal, Canada
John McCrae Fellow in Experimental Surgery, McGill University

THE question of the etiology of pancreatitis has long been a source of keen interest in medicine. Starting with the work of Claude Bernard and Klebs, a great deal of evidence, experimental and clinical, has been gathered in an effort to arrive at some satisfactory explanation for the causation of the condition. During the course of years numerous theories were suggested. These have undergone various modifications until at present we are faced with three possible explanations, each of these three having its own group of supporters.

The first of these deals with the conversion of the common bile duct and the duct of Wirsung into one continuous channel, permitting the entrance of infected or chemically altered bile into the pancreas, thus producing a pancreatic lesion of varying degrees of acuteness. This conversion into one continuous channel is caused either by the impaction of a small stone, or inspissated shred of mucus, in the ampulla of Vater, as suggested by Opie, or by spasm of the sphincter of Oddi, closing off the common entrance of these two ducts into the duodenum, as suggested by Archibald.

The second deals with the possibility of the regurgitation of duodenal contents through the ampulla into the duct of Wirsung; and the third deals with the extension of an inflammatory lesion from neighboring organs, particularly the gall bladder and the bile ducts, to the pancreas by way of the lymphatics.

As will be seen, the last mentioned theory, the lymphatic, deals with the question of the etiology of pancreatitis in its relation to infections of the gall bladder and bile passages.

For many years observers had noted this co-existence of pancreatic and biliary infection, and although many theories as to their relationship had been propounded, it was not until 1899 that the lymphatic route of infection from infected gall bladder and bile passages to the pancreas, was mentioned as a possibility. In that year, Klippel, in an article in the *Archives générales de médecine* on diseases of the pancreas, dealt with the three possible sources of infection that were recognized at that time, namely: the hæmatogenous, the spread by contiguity from the common duct to its surrounding pancreatic tissue, and the ascending route from the duodenum, and he pointed out a fourth possible one, the lymphatic. From that time on, contributions to the etiology of pancreatitis were numerous, but no further mention of a lymphatic route was made up to 1908, when Maugeret, under the direction of Thiroloix, wrote her thesis for the *Doctorate of Medicine* on the question of an infection of the pancreas being produced by lymphatic extension from an inflamed gall bladder or bile passage.

Later Arnsperger came out strongly in favor of this theory, and on this continent it has won the support of Deaver, Sweet, and others. It has been given widespread acceptance clinically both on this continent and in Europe, although the theory has been based on very scanty and indefinite proof.

Although, as above stated, Klippel was the first to suggest the possibility of a lymphatic route, it was Maugeret who first made a definite attempt to produce evidence, anatomical, clinical, and experimental, in its favor. She based her conclusions on a consideration of the lymphatic distribution in that region as described by Sappey, Hoggan, Cuneo, and others; on the presence of enlarged lymphatic glands that were clinically demonstrable in cases of gall-bladder infection associated with the so-called chronic pancreatitis; on the inability of the then recognized routes of infection to account for all cases of pancreatic infection; and lastly, on her experimental findings.

Arnsperger based his acceptance of the theory on the anatomical demonstration of the lymphatic anastomoses between the pan-

[1] This research was carried out in the Department of Experimental Medicine and the Department of Surgery of McGill University and the Surgical Department of the Royal Victoria Hospital. The grant for the scholarship was provided by Mr. H. J. Fuller.

creatic and biliary lymphatics, by Bartels and Franke, on the clinical observations cited above, and on the added observation that metastases of primary carcinoma of the gall bladder were frequently found in the head of the pancreas. His efforts to produce the lymphangitis experimentally met with failure.

Deaver, Pfeiffer, Sweet, and other American observers based their opinion purely on clinical observations, coupled with a rather loose clinical application of the anatomical demonstrations of Bartels and Franke. More recently, however, Graham and Peterman, and Barber, of Bellevue Hospital, have endeavored to bring forward experimental evidence in favor of the theory.

From the foregoing it will be readily seen that the supporters of the theory based their opinion, for the greater part, on anatomical and clinical observations. The experimental evidence brought forward to support their claims was to us unconvincing. It was, therefore, determined, under Dr. Archibald's direction, to carry out a series of experiments in an effort to gather evidence in favor of, or against, this theory.

Before proceeding with an account of our experimental work, it would perhaps be best to give, in slight detail, the conception of the mechanism of infection by the lymphatic route. This is best done by quoting from some of Deaver's articles.

In an article on "Pancreatic Lymphangitis" in the *International Clinics*, in 1914, he states: "The infection spreads from an inflamed gall bladder to the cystic lymph node, then by a periductal lymphangitis through the nodes along the common duct to those at the head and margin of the pancreas and thence to the regional lymphatic distribution to the head of this organ." Again in an article in the *Annals of Clinical Medicine*, in 1923, he states: "the lymphatics of the head of the pancreas which arise in the neighborhood of the bile duct are intimately connected with the lymphatics of the lower end of the bile duct, and these in turn are intimately associated with the lymphatic ducts of the gall bladder. In infection of the regional lymph nodes, this can very easily cause a damming back of the lymph and cause aseptic inflammation of the interstitial pancreatic tissue, with subsequent organization and cicatrization." The subject is also discussed by Deaver in co-operation with Sweet, in the *Journal of the American Medical Association*, for July 16, 1921, in an article in which Sweet considers it from the standpoint of the embryological development of the pancreas.

Turning to our experimental work, our attention was first directed to a recent article by Graham and Peterman, who claimed to have produced a pancreatic lymphangitis. They infected the lymphatics of the liver by injecting organisms into the portal vein. They traced their route of infection from the lymphatics of the liver to the gall bladder, along the common duct, and so to the pancreas. As evidence of having produced a pancreatic lymphangitis, they demonstrated polymorphonuclear leucocytes and bacteria in the interlobular connective tissue.

We first undertook a repetition of their experiments and injected varying quantities of staphylococcus aureus cultures into the portal veins of cats. We used only five animals and in all these we found a pancreatic lesion similar to that described by Graham and Peterman. In addition, we found that identical changes were present in other organs, namely the spleen, kidney, heart muscle, and lungs, making us believe that we were dealing with a generalized bacteriæmia. This was further evidenced by the recovery of the organism in pure culture from the heart's blood in the four cases from which the culture was taken. The frequency with which pancreatitis can be produced hæmatogenously was also amply demonstrated by Abrami and St. Girans, who produced septicæmia in animals by the injection, intravenously, of various organisms with the production of pancreatic lesions.

In the cat, the animal we used in our experimental work, there is a gland which lies on the surface of the pancreas at the junction of the head and body of that organ. This we took to correspond to the gland which is always mentioned by adherents to the lymphatic theory as being enlarged in those cases in which a diagnosis of chronic pancreatitis is made. This gland receives some of the effer-

ent lymph vessels from a small area on the right lobe of the liver, and is supposed to be a relay station in the path of infection from the liver or gall bladder to the pancreas. An effort was made to infect this gland, and the following experiment was carried out.

*Cat No. 329.* The gland at the duodenal angle of pancreas was exposed. Three drops of a twenty-four hour old beef infusion broth culture of staphylococcus aureus, was injected under the gland capsule, and the abdomen closed. Eight days later the cat was found dead. It had been ailing since operation. Autopsy revealed the following: Abdominal wound was well healed. The peritoneal cavity was clean. The injected gland and all mesenteric glands were tremendously swollen, soft, and blue. No evidence of breaking down was seen in injected gland. The pancreas was whitish and firm, but showed no evidence of pathological change. The gall bladder was distended but was not congested; it emptied easily. The liver was apparently fatty. The heart and lungs showed no pathological change. Microscopic examination of sections of injected and mesenteric lymph glands showed distended sinuses filled with polymorphonuclear leucocytes. The glands were œdematous and showed distended, engorged capillaries. Sections of the pancreas showed a normal arrangement of pancreatic acini. Vessels appeared slightly engorged, but no evidence of any active inflammatory change was made out.

This experiment was repeated in three other animals, each having two to three drops of the culture injected under the capsule of the gland. Of these four, one died in 48 hours of a general peritonitis. The remaining three were autopsied 4, 8, and 16 days after the injection. Three of these cats gave positive blood cultures. All four showed a definite, acute, inflammatory lesion to be present in the injected gland. In one case (the one dying of a general peritonitis), both the injected gland and a small portion of the pancreas immediately underlying it, were converted into an abscess cavity. Apart from this localized area, the pancreas, both macroscopically and microscopically, showed nothing except a slight congestion. In the other three cases, gross pancreatic change was absent, and microscopically no inflammatory change could be made out. Slight œdema and congestion were present.

Anatomists have noted a lymphatic trunk which drains a portion of the right lobe of the liver. The efferent vessels then descend on the concavity of the liver, and pass through periductal glands into the gland lying on the head of the pancreas. We endeavored to infect the liver area drained by this group of lymphatics by carrying out the following experiment.

*Cat No. 331,* February 7, 1924. The liver was exposed, and the right lobe inoculated at several points by the injection of 2 to 3 minims of a 24-hour old beef infusion broth culture of staphylococcus aureus, under Glisson's capsule. Cat closed. February 17, 1924: The cat was chloroformed and autopsied. It had been ailing since operation. The thorax was opened and a culture of heart's blood taken. The abdomen was opened. The peritoneum was clean, the liver swollen, purplish, and flabby, but showed no evidence of abscess formation. Markedly swollen, congested glands were noted alongside the common duct (to left), two along upper border of pancreas and at duodenal angle. Mesenteric glands also were enlarged. The gall bladder was pale, soft, and thin-walled. The pancreas was white and soft, and appeared slightly swollen. Microscopic examination showed in the glands alongside the common duct and on the superior border of the pancreas distended polymorphonuclear-filled sinuses; polymorphonuclears were also seen in the interior of the glands. The medulla of glands showed markedly distended capillaries. Sections of liver showed a diffuse invasion of liver tissue with polymorphonuclear leucocytes. The sinusoids were engorged and filled with necrotic material. Pancreas showed a slight widening of the interlobular spaces. No change of a pathological character was discovered.

Four experiments of this type were carried out. Of these four, one showed a positive blood culture, and died in 4 days of a general peritonitis. The liver in this case showed numerous abscesses at points of inoculation, the peritoneum contained a large quantity of pus and there was a small abscess lying in the curve of the duodenum between the duodenal wall and the pancreas. This abscess invaded the pancreas for a distance of about one-fourth of an inch. The pancreas at this point, when examined microscopically, showed all the evidence of acute inflammatory change, but this change was very narrowly localized. Numerous sections from head, body, and tail beyond this area, failed to show any inflammatory change of any kind, although vessels throughout the pancreas were engorged and showed a definite leucocytosis. (Note positive blood culture.)

In the other three animals, on which autopsy was performed on the second, tenth, and fifty-sixth day after operation, there was no pancreatic change at points of inoculation, and in two of these cases inflammatory change was also made out in the lymph glands of the hepatic chain.

Our next group consisted in a series of thirteen animals in which we produced inflammatory conditions in the gall bladder. The mechanism of production varied, three different methods of procedure being adopted. The three following protocols will indicate the methods followed and the results obtained under each method.

*Cat No. 337*, February 20, 1924. The abdomen was opened, and the subhepatic space exposed and walled off. The hepatic artery was freed and ligatured. The cystic duct was exposed, freed of its peritoneal coat, and ligatured. Three to four minims of staphylococcus aureus culture was injected in two areas underneath the serosa of the gall bladder.

February 22, 1924: The cat has been ailing since operation. It died 48 hours after operation. An immediate autopsy was done. The thorax was opened and a culture of heart's blood taken. The abdominal wound was sound. The peritoneal cavity contained a small amount of bile-stained fluid. The peritoneum was congested. The omentum was tucked up into the subhepatic space and was adherent to the liver. The liver was pale, flabby, and covered with thin adhesions. The gall bladder was embedded in the adherent omentum, was congested and showed a large area of coagulated lymph on its surface. The glands on the superior border of the pancreas and at the duodenal angle were swollen and congested. This is fair evidence that ligature of artery and duct had not obstructed the lymphatics. Microscopic examination revealed the following: The gall bladder showed an acute inflammatory lesion invading all the coats. The lymph glands showed inflammatory change evidenced by swelling, congestion, and distended sinuses containing large numbers of polymorphonuclear leucocytes. Pancreatic sections showed congestion of the vessels but no inflammatory or degenerative change of any sort was noted. Blood culture was negative.

*Cat No. 342*, March 17, 1924: The abdomen was opened and the subhepatic space exposed. The gall bladder was large. Seven minims of a 24-hour old beef infusion broth culture of staphylococcus aureus was injected under the peritoneal coat of the gall bladder.

March 20, 1924: The cat has been ailing since operation. It was chloroformed and autopsied. The thorax was opened and a culture of the heart's blood taken. The abdominal wound and peritoneal cavity were clean. The omentum was adherent to the subhepatic space. On separating it from the gall bladder a tiny abscess, lying between the gall bladder and omentum, was broken into. The gall bladder was congested and showed a patchy deposit of coagulated lymph on its surface. The glands of hepatic chain were congested and enlarged. The pancreas showed no gross change. The liver showed a few filmy adhesions on its surface. Microscopic examination of the gall-bladder wall showed definite, acute, inflammatory change affecting all coats. Sections of lymph glands showed a distended peripheral sinus containing large numbers of polymorphonuclears. Sections of pancreas showed absolutely no change.

*Cat No. 346*, March 19, 1924: The subhepatic space was exposed and walled off. The hepatic artery and cystic duct were ligatured. Eight minims of staphylococcus aureus culture was injected under the peritoneal coat of the gall bladder. Ten minims was injected into the gall-bladder lumen.

March 28, 1924: The cat was chloroformed and autopsied. The abdominal wound was infected but the peritoneal cavity was clean. The omentum was adherent to the gall bladder and subhepatic space. The liver was dark and congested. The surface was covered with flakes of organized lymph. The gall bladder was contracted, mottled, thick-walled. It showed a few areas of coagulated lymph on its surface. Enlarged lymph glands were noticed at the cystic duct. One enlarged, congested gland was found lying opposite the lower end of the common duct. Other glands in hepatic chain were found enlarged and congested. No evidence of gross change was found in the pancreas. An enlarged gland was found on the superior border of the pancreas and a culture was taken from its interior. Microscopic examination of the gall bladder showed a definite, acute inflammation affecting all coats. The cystic gland and duct showed acute inflammation. The pancreas was absolutely normal except for slight congestion. The lymph glands were acutely inflamed A culture from the gland showed a pure growth of staphylococcus aureus.

Of the 13 animals in this series, 3 were treated in the same way as Cat 337, 4 in the same way as Cat 342, and 6 as Cat 346. Irrespective of the procedure, cholecystitis was produced in every case. Ten showed definite acute inflammation affecting all coats. Three showed chronic inflammatory change. The first ten were examined in from 2 to 14 days; the last 3 on the sixty-second, the seventy-fourth, and seventy-sixth day after operation, respectively.

In the cat, the lymphatics of the gall bladder and biliary ducts drain chiefly into the group of glands that lie to the left of the ducts and on the superior border of the pancreas;

that is the hepatic chain of glands. The glandular chain of the cystic and common bile ducts which lie to the right and behind these ducts, and which, with the hepatic chain, constitute the lymph glandular system of the hepatic pedicle in the human being, could not be demonstrated by us in the cat. It is even inconstant in man (Delamere). We were, therefore, forced to assume that the glands of the hepatic chain were those chiefly concerned in the drainage of the gall bladder, and in these glands we were able to demonstrate inflammatory change in all the 13 cases, indicating that the inflammation was passing from the gall bladder by way of the lymphatics. Not only did we demonstrate inflammatory change and bacteria in the glands of this chain, but we also were able to recover the organism in pure culture from these glands in two of the cases in which the culture was taken. To demonstrate further that the hepatic chain of glands drained the gall bladder, we injected an iron solution (McCallum's) into the gall-bladder wall and on treating the sectioned glands with N/50 hydrochloric acid, we were able to demonstrate the iron in the gland substance; and it should be noted that sections of the pancreas failed to show the iron.

Examination of the pancreas in these 13 cases revealed the following. In 6 cases in which an autopsy was performed within 7 days of the time of operation, no change, gross or microscopic, could be demonstrated in the pancreas. In 3 out of 4 cases in which an autopsy was performed in from 10 to 14 days, a change was noted in the tissue examined. In 2 cases this change consisted of an infiltration of small round cells in the form of bands into the interlobular tissue, and at one or two points these bands of cells penetrated and invaded the parenchyma itself. These bands were never more than a few cells in diameter and always extended from the periphery to the interior. In some areas they assumed a perivascular formation. They were not associated with any other type of cell. There was no evidence of fixed tissue proliferation, no polymorphonuclears, red blood cells, or any of the evidence of acute inflammation or of any damage to the pancreatic tissue. The parenchymal cells appeared absolutely healthy, even those lying right next to these bands of cells. In one of these cases the change was noted in the duodenal end and body, but not in the tail. In the other, there was no change in the duodenal end, whereas it was present in the body and tail. In all sections vessels were engorged and showed a mild leucocytosis. In the third case, a small localized area of acute inflammation was noted in the section taken from the pancreas immediately underlying a broken down lymph gland which lay on the superior border of the pancreas, about the middle of its body. This acute inflammation was characterized by the polymorphonuclear invasion and some damage to the parenchyma. Numerous sections were taken outside of this area and they failed to show any inflammatory change of any sort.

In 3 cases in which the condition lasted about two and a half months, the picture at autopsy was that of a chronic cholecystitis, and microscopically the gall bladder showed definite chronic productive change. In these cases the pancreas showed no gross change and microscopically there was no evidence of any inflammatory change. The parenchyma in no place showed any evidence of injury, but there appeared to be a slight thickening about the walls of the pancreatic ducts.

In all these cases, 23 in number, in which we endeavoured to produce an inflammation in tissues which might tend to allow a spread by lymphatic extension to the pancreas, we carefully stained and examined all our sections for the presence of bacteria. These we frequently found in the liver, gall bladder, and lymph glands, but never were we able to discover any in the pancreas.

To sum up, then, we have 26 animals that have been experimented upon with the object of producing a pancreatic infection. Sixteen of these definitely show no change of any sort in the pancreas. Two show abscess formation, while three others show a possible inflammatory change. We will discuss these 5 cases in greater detail later. Five other cases, in which we obtained pancreatic change in trying to confirm Graham and Peterman's work, and in which we showed the change to be due to a generalized blood infection, can be classified as cases in which our findings were negative.

Let us now consider the views as expressed by the leading adherents to the lymphatic theory, and let us consider how our present day knowledge, both anatomically and experimentally, would influence these views. We have already set down the mode of causation of this so-called pancreatic lymphangitis as expressed by its leading adherent on this continent, namely, Deaver. His views are in accord with those originally expressed by Maugeret and supported by Arnsperger. Their whole theory hinges on the statement: "in infection of the regional lymph nodes, the infection can very easily cause a damming back of the lymph and cause aseptic inflammation of the interstitial pancreatic tissue with subsequent organization and cicatrization." What proof have they in support of such a statement? No one questions the presence of an anastomosis around the lower end of the common duct as described above. The work of Bartels, Cuneo, and Charpy has demonstrated that. The fact that it exists, however, does not furnish proof that an infection can follow the course that it is presumed to take by the supporters of the lymphatic theory. It must not be forgotten that the lymph stream has a definite direction of flow, and furthermore, numerous valves are present in the lymphatic vessels which would offer quite a barrier to the mechanical damming back of their contents. The anastomosis of the lymphatics occurs outside of the pancreas, and by the time they have left that organ the vessels have passed from the capillary to the collecting trunk stage, and these collecting trunks not only possess valves but their walls have a definite muscular structure, this structure maintaining the direction of flow. It is apparent then, that in order for a damming back of lymph to take place, not only is it necessary to do away with the valvular action in these trunks but their muscular action must be entirely inhibited—a condition somewhat difficult to conceive. Some observers in their acceptance of the theory attempt to draw an analogy between the axillary glands receiving collecting trunks from an arm, breast, and chest wall; and the peripancreatic glands receiving trunks from pancreas, bile duct, and periduodenal tissue. Admitting that conditions are analogous, how many have seen a case in which an axillary adenitis, arising from an infected hand or arm, has resulted in inflammatory change in either breast or chest wall? Deaver, in an earlier article, took cognizance of the presence of valves and the muscular structure of the walls of the lymphatics and claimed that under pathological conditions, the normal function would be entirely done away with. This is an assertion based on no definite proof. We have no evidence of lymph-borne infection in any part of the body ever having gone against the lymph current. According to their conception the pancreatitis affects the interstitial tissue only. If the lymph were dammed back at all, surely the back pressure would be communicated to the finer radicles (which are devoid of valves), and finally to the actual lymph spaces, and there would be some manifestation of damage to individual pancreatic cells.

A great many investigators quote the work of Franke as conclusive proof that one can infect the head of the pancreas from the gall bladder by way of the lymphatics. Franke's work consisted in the demonstration of a lymphatic route, by means of color injection, from the gall bladder to the gland lying on the head of the pancreas and from there a series of trunks lying on the head of the pancreas. He did not claim, however, nor did his illustrations show, that any of the colored material had entered the pancreas. Bartels, too, has been generally misquoted and misinterpreted. It is true that he demonstrated an anastomosis between pancreatic lymphatics and the lymphatics of the duodenum and other adjoining organs outside the pancreas, but he failed in his attempts to inject the intrinsic pancreatic lymphatics from the duodenum, because, as he explains it, of the competency of the valves of the pancreatic lymphatics.

Let us now consider what the experimental end of this problem has to offer. Maugeret, in 1908, was the first to bring forward experimental evidence in attempting to support her theory. She attempted to produce a cholecystitis by the injection of formalin and lampblack into the lumen of the gall bladder in a series of dogs. The gall bladder and the pan-

creas were examined in from 2 to 46 dogs, and she pointed out the macroscopic lymphatic gland swelling and an interlobular leucocytic infiltration in the pancreas as evidence of having produced a pancreatitis, lymph-borne. An examination of her protocols shows no definite microscopic evidence of inflammation in the gall bladder or lymph glands, although the pancreatic lesion is made evident. Second, that although the larger pancreatic duct, in the dog, opens separately from the common bile duct, the smaller pancreatic duct opens through a common ampulla with the bile duct, and no effort was made to preclude the possibility of some of the irritating chemical entering this duct and producing a resultant pancreatic inflammation. Her experimental findings must, therefore, be looked upon as inconclusive.

Arnsperger, in 1911, attempted to produce experimental pancreatic lymphangitis in rabbits, but he failed absolutely to produce any pancreatic change. Although a strong supporter of the theory from a clinical point of view, he confessed his failure to produce the condition experimentally, explaining his inability to do so on the grounds that conditions in the rabbit differed too much from those in the human.

Nordman, in 1913, working on the general problem of the etiology of pancreatitis, produced severe gall-bladder infection, with enlargement of the regional glands, and leaving the lower pancreatic duct open, he failed to get any change in the pancreas. All his animals (dogs) died of an ascending cholangitis in 5 to 7 days. His work directly contradicted that of Maugeret.

The work of Barber, of Bellevue, calls for some consideration. He claims to have produced experimental acute cholecystitis in 25 cases, and furnishes us with his results, in table form, in 18 cases. In the text of his article he states: "Chronic pancreatitis has been reproduced experimentally in the animals of the series herein reported. The signs taken to denote 'pancreatitis' *in vivo*, namely, enlarged pancreas or head of gland, hardening, more distinct lobulation or roughening with or without enlarged lymphatic glands, were present. The microscopical picture in this type of gland may show congestion or slight round-celled infiltration, or a slight fibrosis, but the epithelium remains intact. This sort of pancreatitis is believed to characterize pancreatic lymphangitis, repeatedly described by Deaver and to be the product of lymph-borne infection from the liver in certain of the cholecystitis cases."

An examination of his table shows his report to be incomplete, but from the data furnished we gather the following. Acute congestion in the pancreas was present in one case, positive cultures from the pancreas in two cases, necrosis in two cases, fibrosis in one case, and peripheral infiltration in one case.

Acute congestion alone we cannot accept as evidence of a lymph-borne infection of the pancreas. Many factors could contribute to the production of such a condition—a blood infection, inflammation of the peritoneum overlying this organ, trauma in section taking at autopsy, and so on.

The findings of a positive culture in two instances can not be accepted as proof of the pancreas having been infected. Many observers have noted the bactericidal property of pancreatic juice and, moreover, Barber himself states that the mere finding of bacteria in blood or tissue does not appear, therefore, to constitute in itself a diseased condition. The two cases in which he found necrosis I cannot discuss in the absence of any detail, particularly when in 26 of my own cases, necrosis was conspicuous by its absence.

There remain but the two cases labeled "fibrosis" and "peripheral infiltration." If by that is meant the slight fibrosis and slight round-celled infiltration previously mentioned as evidence of pancreatitis, I can only quote the work of Thomas Ordway, who, in examining a series of apparently normal cats, found lesions of a chronic inflammatory nature in the pancreas of many of them. I do not know what animals Barber used, but these slight inflammatory changes have been noted by various observers in the organs of other animals, and have been regarded as being normal to these animals.

All in all, Barber's results cannot be looked upon as furnishing us with convincing proof of

the possibility of a pancreatic infection being produced by lymphatic extension from the gall bladder.

Turning to our own work, we find 5 cases out of 26 in which pancreatic change of a possible inflammatory character was noted. In the first case, in which both injected gland and underlying pancreatic tissue were fused into an abscess cavity, and in which the pancreas outside of this area was absolutely normal, we cannot help but feel that this abscess was the result of a direct spread by contiguity from the gland to the underlying pancreatic tissue, and not a lymph spread.

The second case showed a small polymorphonuclear invaded area lying directly underneath a suppurating, broken-down gland on the superior border of the pancreas. This, too, must be looked upon as a spread by direct contiguity. Here, again, the pancreatic tissue immediately outside the invaded area was absolutely normal and numerous sections of the head, body, and tail failed to reveal any lesion whatsoever.

The third case, in which we found an abscess invading a portion of the surface of the pancreas, a case in which the liver had been infected, a severe general peritonitis was present and abscesses were noted in the liver at points of inoculation and in the great omentum. We feel that this abscess formation was the result of the infection attacking the pancreas from the peritoneal surface and that it was not conveyed from the liver to the pancreas by way of the lymphatics.

Only the two cases remain in which bands of small round cells were found invading the pancreas. The slides of these cases were carefully examined by Dr. Archibald and members of the pathological staff of McGill University. The consensus of opinion was that the condition was not an inflammatory one and that it was a condition normal to the animal. If this round-celled infiltration were due to an inflammatory irritant, there would have been a more diffuse invasion with some damage to the parenchyma. The condition present was too patchy and irregular in its distribution. When one couples that with the work of Ordway as previously recorded, we feel that these two cases must be considered as furnishing us with negative findings.

## CONCLUSIONS

From a careful study of the foregoing, the following conclusions must be drawn.

1. No proof has been produced that would permit us to accept the lymphatic theory on anatomical grounds.

2. The experimental evidence, in the light of our results and the consideration of the results of other investigators, fails to demonstrate a lymphatic route of infection to the pancreas.

3. The clinical proof which has always been based on the assumption that experimentally and anatomically, the lymphatic route of infection was possible, must, of necessity, be regarded as not existing.

From these conclusions, it will be readily seen that the theory of the causation of pancreatic infection via the lymphatics from an inflamed gall bladder, liver, or bile duct, is inadmissible.

## BIBLIOGRAPHY


ABRAMI, RICHET, and ST. GIRANS. Soc. de Biol., Paris 1910.

ARCHIBALD. Ann. Surg., 1921; Surg., Gynec. & Obst., 1919.

ARNSPERGER. Muenchen. med. Wchnschr., 1911.

BARBER. New York State J. Med., 1922.

BARTELS. Arch. f. Anat. u. physiol. Anat., 1904, 1906, 1907.

CUNEO. Traité d'anatomie de Pairier et Charpy.

DEAVER. Internat. Clin., 1914, xiv, s. 111; Ann. Clin. Med., 1923.

DEAVER and PFEIFFER. Tr. Am. Surg. Ass., 1913, xxxi; Ann. Surg., 1914, lix; Tr. Am. Surg. Ass., 1922.

FRANKE. Deutsche Ztschr. f. Chir., 1911, Sept.

GRAHAM and PETERMAN. Arch. Surg., 1923.

HOGGAN and HOGGAN. J. Anat., 1880.

KLIPPEL. Arch. gén. de méd., 1897, Nov.

KLIPPEL and LEGOS. Arch. gén. de méd. 1899, July.

MAUGERET. Paris Thèses, 1907–1908.

NORDMAN. Arch. f. klin. Chir., 1913, cii.

OPIE. Diseases of the Pancreas. Lippincott.

ORDWAY. J. Med. Research, 1909, xvi, Oct.

SWEET, E. Surgery of the Pancreas.

# ACUTE THYROIDITIS

By HOWARD M. CLUTE, M.D., F.A.C.S., and LAWRENCE WELD SMITH, M.D., Boston

From the Lahey Clinic and the Pathological Department of the Harvard Medical School

IT has been noted for many years by clinicians and pathologists alike that cases of acute thyroiditis are extraordinarily rare, as compared with acute suppurative inflammatory processes of any of the other glandular tissues. Hagenbuch (12) found but 43 cases among 45,953 medical and surgical admissions to the Basle Clinic during a ten-year period. In a recent series of nearly twelve hundred cases of thyroid disease seen in the Lahey Clinic, there have been but 1 case of frank suppurative pyogenic thyroiditis, 1 of tuberculous thyroiditis, and the 5 chronic inflammatory granulomatous Riedel's strumitis cases previously reported. In no case seen during 1925 could we make a clinical diagnosis of acute thyroiditis. In our experience previous to 1925 we have seen 4 patients in whom the purely clinical or operative diagnosis was clearly acute thyroiditis. Only three out of over three thousand thyroid operations in this Clinic have been done for thyroiditis with abscess formation.

## ANATOMICAL CONSIDERATIONS

There are a number of significant facts which help explain the rather unexpectedly small number of cases. In the first place, the thyroid is well encapsulated by the fascial compartments of the neck, and except in the rare cases in which embryological persistence of the thyroglossal duct is noted, there is no direct communication with the pharynx. This point is emphasized since among the possible causes of Riedel's struma has been cited the fact that inflammatory processes of the trachea or pharynx could reach the thyroid by way of the post-branchial body, as reported by Meeker (21) in a single instance. In the second place, the thyroid has a very unusual lymphatic system which enables the gland to be drained to a degree unequaled in any of the other parenchymatous organs. This anatomical peculiarity of the thyroid has been recently well brought out by the work of Williamson (28). In the third place, certain authors have ascribed a local bactericidal function to the thyroid secretion.

## PHYSIOLOGICAL CONSIDERATIONS

Our knowledge of the physiology of the thyroid is still so obscure, however, that we have to rely very largely upon our knowledge of its anatomical structure to hypothecate the mechanism of its functional activity. On the basis of the anatomical development of the thyroid in certain of the lower vertebrates, it appears that there is an unusually intimate relationship to the lymphatic system, and it is probable that the secretion of the thyroid gains access to the blood stream and body in general fully as much by way of these lymphatics as by direct absorption into the blood vessels. Although it is true that there is a rather specialized anastomotic arrangement of the capillaries within the anatomical lobule of the thyroid, it is obvious that such secretion must reach the body tissues ultimately by way of the blood stream, and it is perhaps only of academic interest to quibble over this point. It does seem of some importance, however, in relation to the absence of the usual acute infections so common in glands possessing a duct. This in itself, by way of corollary, suggests that many of the inflammatory lesions of the other glandular organs are ascending infections except in the case of septicæmic processes, where multiple abscesses are prone to result. This is undoubtedly often lost sight of, and a hæmatogenous origin erroneously attributed to rather common inflammatory reactions in other organs.

## MORBID ANATOMY

Pathologically, acute thyroiditis shows the anatomical changes which acute inflammation elsewhere presents, namely, dilatation of the capillaries with diapedesis or even frank hæmorrhage, depending upon the amount of damage to the endothelium. Inasmuch as the

vascular supply of the thyroid consists almost entirely of minute capillaries supported in a fibro-elastic stroma, it is obvious that hæmorrhage is one of the early features of the pathology. Subsequently, there is the usual leucocytic infiltration which tends to be rather diffuse within the anatomical lobule. In typical cases the leucocytes are found to invade the alveolar epithelium and even to be found within the lumina of the acini. Accompanying this reaction there is usually a diminution in the amount of colloid within the follicles, although this finding is by no means constant. In its place there tends to appear a granular serous precipitate, which represents probably the secretory product of the epithelium and is to be distinguished from the normal colloid retention.

Following this diffuse inflammatory reaction. one of two things ordinarily occurs: either the inflammatory process localizes as it does in other tissues, or it subsides relatively rapidly, leaving a certain residuum.

In the first instance, this leads to definite abscess formation, and here, as elsewhere, the degree of destruction depends largely upon the type and number of the infecting organism and the individual's resistance. With acute suppuration, the abscess either extends to involve the surrounding tissues with rupture occasionally into a vessel or even into the trachea, or healing occurs by the destruction of the bacteria by the leucocytes and cellular enzymes and the lesion is replaced by fibrous scar tissue.

If, on the other hand, the lesion subsides spontaneously, without localizing in this fashion, we may find evidence of its previous existence in the presence of definite foci of lymphocytic infiltration scattered throughout the interlobular stroma. This raises a point of considerable uncertainty in histological interpretation. There are a number of difficulties which immediately occur in deciding the significance of such a reaction. It has long been a debatable point as to whether Graves' disease was associated with any inflammatory lesion of the thyroid. Many observers have noted the presence of these groups of lymphoid cells in hyperplastic glands, and have credited them as being of etiological significance in the development of the hyperplasia. On the other hand, we have observed in so many extremely toxic goiters no evidence of such cellular infiltration, that we strongly feel that the mere hyperplasia of the glandular epithelium with the associated increased metabolism bears no direct relationship to this cellular inflammatory reaction. We feel, however, that it is quite probable that such hyperplastic goiters are more prone to injury, and accordingly they are subject to mild inflammatory processes which on subsiding leave this cellular aftermath. Indirectly, therefore, in this way a relationship may exist between these small foci of chronic mononuclear inflammatory cellular infiltration and the hyperplastic goiter of Graves' disease.

Similarly, in the clinical group of so-called "multiple colloid adenomatous goiters" these inflammatory zones can be found. We think it is highly probable that they represent the end-result of some associated subacute inflammatory process. In this instance we feel that there may be some causal relation in the production of the adenomatous type of goiter.

The multiple colloid type of adenomata histologically has a rather definite appearance which suggests a metabolic disturbance rather than a true tumor, for areas are found scattered through the gland where either hyperplasia or involution of the glandular epithelium can be found. With mononuclear cellular infiltration of the interlobular septa, and their accompanying fibrosis, we feel it is perfectly possible that this artificial lobulation may be quite definitely exaggerated and result in disturbance of the blood supply which may affect materially the secretory activity of the acini. Probably such glands never go through any very severe acute inflammatory reaction, but represent a chronic or recurrent type of lesion more to be compared with the chronic progressive fibrosis seen in the liver and kidney. When we look for the causal factor we usually cannot find it, or we find it associated with some distant focus of infection.

Certain authors have stressed the differential diagnosis between the acute inflammatory reaction in the normal thyroid (thyroiditis) and that in the goitrous gland (strumitis). This seems to be a rather artificial line of

demarcation in view of our present inadequate knowledge of even the mechanistics concerning thyroid function. The paradoxical picture of endemic colloid goiter and a low iodine content; the normal hyperplasias of puberty, pregnancy, and even of menstruation; the meaning of "fetal" adenomata are all simple illustrations of our ignorance. The normal balance between colloid retention and glandular secretion varies apparently with the individual. From the histology alone we cannot, with any regularity, accurately even estimate the basal metabolism nor the iodine content which are our chief yardsticks of functional activity. In the study of the thyroid, where physiology ends and pathology begins is a peculiarly difficult problem, and the establishment of a separate nomenclature for inflammatory processes in various types of thyroid glands seems unnecessarily to complicate the problem.

In thus discussing the inflammatory processes of the thyroid we have departed somewhat from the classical method. It is interesting to note the relative paucity of literature on this particular aspect of thyroid disease. Most of the references are to brief case reports, and go very little into discussion. It is obvious that infection of the thyroid must occur in one of three or four ways: (1) by direct extension of some perithyroid infection; (2) by traumatic invasion of the capsule; (3) by extension through a persistent thyroglossal duct; or (4) by the blood stream. Of these, equally obviously, the latter is the most frequent.

In the accumulated literature we find almost all the bacteria implicated as possible etiological agents. In general, however, it is true that the upper respiratory type of infection seems to be more frequently found as the precursor of thyroid inflammation than any other particular type, although typhoid, paratyphoid, and various other organisms have been reported.

Acute thyroiditis, commonly designated "simple thyroiditis" may occur in a thyroid gland apparently normal before its onset. When the acute inflammatory process attacks a thyroid gland which is already the seat of degenerative changes and contains a goiter, the process has been called "strumitis," and this latter is much more frequently reported in the literature. Sabrazes (24) found that 50 per cent of his cases had had a goiter previous to the acute infection. Hagenbuch (12) reports 43 cases of thyroiditis in which only 5 had no previous goiter. Klose (14) believes that inflammation occurs only in thyroid glands which have been the seat of some previous pathological condition, more especially multiple colloid adenomatous goiter. In these nodular goiters, he says, the vessels are often degenerated, the blood supply is poor, and these facts predispose to infection. We have seen no case of acute thyroid infection arising in a previous goiter. These reports are from cases observed in territory where goiter is endemic, which would of course influence largely the probability of occurrence of strumitis.

Janney (13) states that thyroiditis occurs in children secondary to various acute infections such as measles, mumps, diphtheria, scarlet fever, typhoid fever, and malaria. Thyroiditis has also been reported in men as old as 64. Acute thyroiditis, however, most frequently occurs during young adult life. This fact is thought by some writers to be related to the changes in the physiology of the thyroid gland that accompany active sexual life. Grimault and Brino (11) report a case of acute thyroiditis with abscess formation occurring during pregnancy. Their patient had a goiter that increased in size with each of 6 pregnancies and infection occurred with the last pregnancy. These authors found in the literature 7 other cases of thyroiditis, with abscess formation, occurring during pregnancy. They believe the changes in the size, shape, and blood supply of the thyroid gland that occur during pregnancy predispose to infection. Vallois and Roume (25) also report a case of acute thyroiditis in a goitrous thyroid occurring 15 days after normal pregnancy and delivery.

The striking thing in the case reports of acute thyroiditis is the frequency with which infection in the upper or lower respiratory tract precedes its onset, or the bacteria recovered from the case fall into the groups commonly found in the upper respiratory tract.

Of 43 cases of thyroiditis reported by Hagenbuch, pneumococci were present in 9, 8 cases followed influenza, 3 cases followed pleurisy or respiratory tract infection, 6 cases followed Vincent's angina, and 1 case each came after tooth extraction and meningitis. In the remaining cases no etiological factor was determined. She reports that in 1918 alone she saw 1,643 cases of influenza, in 659 of which pneumonia developed. Three of these patients presented the picture of acute thyroiditis, an incidence of 0.18 per cent of thyroiditis in influenza. We have seen 1 case of acute thyroiditis secondary to influenza. Beilby (1) reports three cases of acute thyroiditis, all of which were related to an upper respiratory tract infection. Greenberg (10) reports a case occurring after repeated attacks of sore throat in which the pus showed the presence of pneumococci. Rendelman (8) had a case after tonsillectomy. Edwards (7) reports 4 acute infections of the thyroid gland with abscess formation, 3 of which clearly followed a respiratory infection. The etiology in the fourth case was not clear but there had been a previous pharyngitis. Bullowa (3) had a case following chest injury and tonsillitis. Bruggemann (2), Rebattu and Gaillard (23) report cases of thyroiditis following chondritis and perichondritis of the laryngeal cartilages.

It has been commonly believed that acute thyroiditis during the course of typhoid fever was not infrequent. Osler and McCrae (22), however, saw no cases in the 1,500 patients with typhoid fever that they studied. Hagenbuch (12) saw no case of thyroiditis in 173 cases of typhoid fever. Tournewt (8) describes a case of acute thyroiditis occurring during the course of typhoid fever, and Sabrazes (24) also saw a case of typhoid thyroiditis. In a search of the literature he found 16 other cases in whom 50 per cent had a goiter previous to the acute typhoid thyroiditis. Lemierre and Taberlet (18) report a case of thyroiditis due to infection with paratyphoid A bacillus and Carnot and Blaumontier (5) report a thyroid gland abscess due to infection with the paratyphoid B bacillus. We have had a patient with typical severe primary hyperthyroidism who first developed fever immediately after a subtotal thyroidectomy. He had typhoid fever and died 4 weeks later from repeated intestinal hæmorrhages. At no time after his operation did his neck show any evidence of infection or thyroiditis. It is obvious, then, that acute thyroiditis may occur during the course of a systemic typhoid or paratyphoid infection but that the condition is very uncommon.

Lemierre (18) reports the occurrence of parotitis, epididymo-orchitis, and thyroiditis in the course of a severe meningitis.

We have seen one abscess of the thyroid gland develop during the course of a septicæmia with hæmolytic streptococcus blood cultures. Caliceti (4) reports a similar case. Weeks (8) reports a case after erysipelas. Osler (22) states that acute thyroiditis may occur in the course of smallpox, measles, pneumonia, rheumatic fever, and mumps, and that thyroiditis epidemics have been reported.

We find no reports of cases that will permit us to ascertain whether a true acute inflammatory reaction occurs secondary to various acute infections in children, or whether there is merely a physiological thyroid gland hypertrophy during a period of stress.

It is apparent, from a study of individuals suffering from acute thyroiditis, and of the literature dealing with the subject, that infection of the thyroid gland is almost invariably secondary to infection elsewhere in the body. Primary infection of the thyroid gland may occur from wounds of the neck which involve its structure. Such cases were seen in the World War, but they are very few, in the aggregate.

### CLINICAL SYMPTOMATOLOGY

The onset of symptoms in acute thyroiditis is usually acute and is marked by fever, chills, and pain in the throat and neck. Difficulty in breathing occurs early in the disease, and, if abscess formation occurs, increases rapidly. A hacking cough and a constant sense of pressure or fullness in the neck is present. Hæmoptysis may occur and frequently there is a constant desire to swallow or to clear the throat. The voice may be hoarse, but complete aphonia is very unusual. Pain, localized in the portion of the thyroid that is inflamed, is very constant. If the process of inflamma-

tion is limited to one lobe of the thyroid gland, the pain may be one sided and frequently will radiate to the back and side of the neck or to the ear. The patient holds his head forward to relax his prethyroid muscles and relieve this pain. Painful and difficult swallowing is frequently present, especially with abscess formation. Lahey (17) has called attention to the characteristic attitude which the patient with thyroid abscess adopts when swallowing. He bends his head forward and lowers his chin in order that he may avoid the pressure of the prethyroid muscles on the thyroid gland during the movements of deglutition. Symptoms of hyperthyroidism may occur with the acute infection of the thyroid. They may disappear when the infection quiets down or they may persist (14, 12, 10, 8).

The physical findings in acute thyroiditis are usually quite characteristic. Swelling in the neck is not prominent, but some enlargement of the thyroid gland can often be detected. This enlargement may be one-sided or diffuse and symmetrical. The thyroid gland is very tender and detailed palpation is therefore impossible. The gland feels harder than normal and may appear to be indurated. Nodules may, of course, be felt in the adenomatous type of goiter.

Local heat and redness are rarely if ever found and œdema over the inflamed thyroid is likewise very unusual. Fluctuation in abscess formation is usually not detected because of the depth of the abscess from the skin and because the muscular layers which overlie the gland do not permit of its accurate palpation.

Small lymphatic glands may be found along the course of the jugular vein in certain cases. Leucocytosis is said to be frequently present (12). In the early stages of the inflammation, the tender thyroid moves with deglutition. If, however, the inflammation extends beyond the capsule of the thyroid gland into the surrounding tissues of the neck, the mass may not move with deglutition.

### COURSE AND COMPLICATIONS

Simple acute thyroiditis runs a benign course, usually lasting but 6 to 10 days. The fever falls by lysis and the local tenderness and sense of pressure disappears with it. Abscess formation in simple thyroiditis is very rare. Some writers believe it never occurs in a gland previously normal. Abscess formation is much more common in thyroiditis occurring in a goitrous gland. Ewald says it occurs in 60 to 70 per cent of cases. Hagenbuch found abscess formation in 68 per cent of her cases. The abscess, if unrecognized and undrained, may rupture on to the surface of the neck or into some neighboring viscus such as the œsophagus, trachea, or mediastinum (14). These accidents usually result fatally.

Œdema of the larynx with suffocation or less marked respiratory embarrassment from tracheal pressure and stenosis may occur. Bronchopneumonia may arise during the infection. Exophthalmic goiter may develop with the thyroiditis and its course subside with the attack of thyroiditis or continue after the acute symptoms of thyroiditis have disappeared.

Chondritis and perichondritis of the laryngeal cartilages have been reported as a secondary complication of acute thyroiditis.

### DIAGNOSIS

The diagnosis of acute thyroiditis is generally readily made. A sudden hæmorrhage into a thyroid adenoma may resemble acute abscess formation in certain respects. Thyroiditis, however, follows an infection as a rule. Hæmorrhage follows exertion. Thyroiditis is marked by high fever and malaise. Hæmorrhage has no constitutional reaction. Thyroiditis has increasingly severe pain. Hæmorrhage has a sudden severe pain that rapidly disappears (12). Malignancy may cause a relatively rapid thyroid growth, but even so, this occupies weeks or months. Acute thyroiditis is rapid in its onset and in its course.

Cellulitis of the neck may closely resemble thyroiditis when seen late in its course. Cellulitis usually is accompanied by little pain at its onset. Thyroiditis starts with severe pain which may become less severe if the inflammation spreads from the thyroid gland to the near-by tissue planes in the neck. Cellulitis usually starts high in the neck, thyroiditis usually starts low in the neck.

Perichondritis of the trachea or of the thyroid cartilage may be completely inseparable from thyroiditis. If, by chance, the tenderness can be clearly localized to the thyroid cartilage or to the tracheal cartilage rather than the thyroid gland, perichondritis may be suspected.

### PROGNOSIS

The prognosis in simple thyroiditis is excellent. It is apparently a self-limited disease in which healing occurs rapidly and completely. Recurrences have been reported, but they are rare. The prognosis in the presence of abscess formation is very good if proper treatment is given at an early date. Cases which develop abscesses that go long without treatment (18) may have serious complications, due to perforation of the mediastinum, trachea, or œsophagus by the abscess. Hagenbuch reports 2 deaths in 47 cases (4 per cent). No other mortality rate was found in the literature.

### TREATMENT

The treatment in simple thyroiditis is to be directed toward the relief of the major symptoms. An ice bag to the prethyroid region is appreciated by the patient. Sedatives, such as a combination of aspirin and codein, are often necessary for the pain. Specific curative measures should be taken when the etiology of the condition is known. Thus Sabrazes, Sainte Marie, and Alain report the treatment of acute typhoid thyroiditis with typhoid vaccine. Their patient recovered without abscess formation or operation. Of the 16 cases of typhoid thyroiditis they found in the literature, operation had been necessary in 13. Lemierre and Taberlet (18) gave anti-meningococcus serum to their patient with meningococcus septicæmia who had developed thyroiditis as well as parotitis and epididymitis. The patient recovered with no complications. Thyroiditis secondary to mumps, measles, diphtheria and scarlet fever usually disappears without any special treatment.

Abscess formation is to be carefully watched for during the course of thyroiditis, and when it has occurred, early incision and drainage are indicated. In cases in which it seems likely that the infection has gone beyond the borders of the thyroid gland, immediate operation is indicated. It is our feeling that early operation should be done in cases of possible abscess formation. Fluctuation is so rarely present that it is a mistake to withhold operative interference until it appears.

Acute thyroid abscess must be approached carefully by the surgeon. In our experience gas-oxygen anæsthesia is preferable to local anæsthesia. A collar incision is made in the neck over the thyroid gland; and the skin, fat, and platysma lifted as in the usual goiter operation. The sternohyoid and the sternothyroid muscles are now raised from the thyroid gland and with retractors held outward in order that the affected lobe of the thyroid may be palpated as well as inspected. Many times the abscess cavity will be opened during this process. It can then be wiped out and drained with a small rubber tube and a cigarette drain. Should a thyroid lobe be encountered which is the seat of multiple small abscesses, a subtotal hemithyroidectomy should be done. For this operation the muscles should be cut and the usual technique of subtotal thyroidectomy followed.

When the abscess occurs in one adenoma of a multiple colloid adenomatous goiter, the abscessed adenoma should be removed if the local and general condition of the patient will permit.

### BIBLIOGRAPHY


1. Beilby, G. E. Acute thyroiditis. Albany M. Ann., 1919, xl, 173–179.
2. Bruggemann, A. Laryngeal perichondritis simulating thyroiditis. Deutsche med. Wchnschr., 1920, xlvi, 97.
3. Bullowa, J. G. M. A case of acute thyroiditis. Med. Clin. N. Am., 1921–22, v, 1125–1128.
4. Caliceti, P. Su un raro caso di ascesso della tiroide consecutivo a setticopiemia otitica senza trombosi del seno trasverso. Policlin., Rome, 1918, xxv, sez. prat 1219–1223.
5. Carnot and Blamoutier. Thyroidité suppurée bacille paratyphique B. Bull. et mém Soc. méd. d. hôp. de Par., 1923, 3.s. xlvii, 65–68.
6. Duttman, E. Paratyphoid B. thyroiditis. Muenchen. med. Wchnschr., 1924, lxxi, 105.
7. Edwards, C. R. Acute infection of the thyroid gland. J. Am. M. Ass., 1921, lxxvi, 637–639.
8. Funk, E. H. Acute thyroiditis. Prog. Med., Phila., 1921, 11, 313.
9. Gilman, P. K. Acute suppurative thyroiditis. California State J. M., 1921, xix, 294.
10. Greenberg, D. Metastatic abscesses of the thyroid associated with hyperthyroidism; report of case following repeated attacks of sore throat. J. Am. M. Ass., 1920, lxxiv, 165.

11. Grimault, L., and Brino, H. Suppurating strumitis during puerperal infection. Gynéc. et obst., Par., 1922, vi, 167–175.
12. Hagenbuch, M. Inflammation of thyroid (strumitis). Mitt. a. d. Grenzgeb. d. Med. u. Chir., 1921, xxxiii, 181.
13. Janney, N. W. Diseases of the thyroid gland. In Abt's Pediatrics. 1924, iv, 680–714.
14. Klose, H. The acute inflammations of the thyroid; their etiology, course, and surgical treatment. Berl. Klin. Wchnschr., 1920, lvii, 202.
15. Kummer, R. H. Pneumococcus thyroiditis and prevesical abscess. Rev. med. de la Suisse Rom., 1920, xl, 362.
16. Kyle, J. J. Abscess of the thyroid gland. Med. Times, N. Y., 1917, xlv, 259.
17. Lahey, F. H. Thyroid abscess; with mention of two new signs of this condition. Boston M. & S. J., 1917, clxxvi, 94.
18. Lemierre, A., and Taberlet. Thyroidite suppuree a bacille paratyphique A. Bull. et mém. Soc. méd. d. hôp. de Par., 1913, 3.s. xliii, 513.
19. Lussana, S. Necrosis of cricoid cartilage and first ring of trachea from acute suppurative strumitis. Arch. ital. di chir., 1923, viii, 522–528.
20. Maier, M. Zur Differential diagnose zwischen Perichondritis laryngis und Thyreoiditis bzw. Strumitis. Berl. klin. Wchnschr., 1921, lviii, 230.
21. Meeker, L. H. Am. J. Path., 1925, i, 57.
22. Osler, Sir William, and McCrae, Thomas. The Principles and Practice of Medicine, 1912.
23. Rebattu, J., and Gaillard, R. Thyroidité aigue suppurée et perichondrite du cartilage thydoide d'origine streptococcique. Lyon méd., 1923, cxxxii, 729–734.
24. Sabrazes, J., Sainte Marie, F., and Alain, P. Vaccine treatment in thyroiditis from typhoid. Compt. rend. Soc. de biol., Par., 1925, xcii, 101–103.
25. Vallois and Roumé. Sur un cas d'inflammation du corps thyroide dans les suites de couches. Bull. Soc. d'obst. et de gynéc. de Par., 1922, xx, 662.
26. Viola, F. Riforma med., Napoli, 1924, xl, 465.
27. Weeks, L. M. Brit. M. J., 1920, 476.
28. Williamson, G. S. Brit. J. Surg., 1926.

# SWELLINGS OF THE MALE BREAST[1]

By EDMUND ANDREWS, M.D., F.A.C.S., and OTTO F. KAMPMEIER, Ph.D. M.D., Chicago
From the Departments of Surgery, and Anatomy, University of Illinois.

THE literature on diseases of the male breast is voluminous but critical studies of the subject as a whole are scarce. The many papers on neoplasms are inclined to give an erroneous impression of the relative frequency of benign and malignant conditions. In fact, from a study of the literature, one would assume that such an overwhelmingly large majority of swellings are cancer, that excision of any one seen is the only safe course. In a series of tumors of the male breast, Schuchardt (46) reports 274 malignant and 21 benign tumors. Palermo (37) also reports an overwhelming percentage of malignancies. The cases in the two series are tabulated as follows:

| | Palermo | Schuchardt |
|---|---|---|
| Cancer | 649 | 247 |
| Sarcoma | 24 | * 0 |
| Adenoma | 5 | 3 |
| Adenofibroma | 22 | 2 |
| Fibroma | 26 | 3 |
| Cysts | 9 | 15 |
| Myoma | 1 | 1 |
| Enchondroma | 1 | 1 |
| Tuberculosis | 0 | 2 |
| Angioma | 7 | 0 |
| Lipoma | 5 | 0 |
| Myxoma | 1 | 0 |

* Classed with cancer.

Billroth (8) said that benign breast swellings in the male were rare and usually went on to suppuration. Gibson (18) said that most male breast tumors were malignant. Rodman (44) saw 11 breast tumors in males of which 9 were malignant.

Paget (36) says that of all cancer in the male, 2 per cent is primary in the breast.

Henry (21) reports 196 cancers of the female breast to 4 of the male. Billroth (8) saw 252 in women and 7 in men. Shields (47) describes 628 in females and 9 in males. Muelleder (33) gives the ratio as 600 to 12. Yamamato (59) collected a very large series in which 11,654 were females and 167 males. Speed (49) and Speese (50) in summing up the literature conclude that the ratio is about 1 to 50. Most of these authors therefore give one the impression that swellings of the male breast are mostly malignant neoplasms, and this view is reflected in modern textbooks on surgery. Da Costa (11) does not even mention mastitis in the male. Carson (9) in Bryant and Buck's *Surgery* also fails to mention it and quotes Spalteholz as saying that the male breast contains only rudiments of gland structures, a gross error, as our work shows. Ashhurst (4) neglects the subject. Finney (14) in Keen's *Surgery*, says that mastitis is rare and quotes Leudet as to the tuberculous nature of such swellings, in reality an exceedingly rare type. Deaver (12) and also Rodman (44) although they discuss mastitis, give quite erroneous impressions as to its frequency.

The importance of mastitis has been recognized by a number of authors. Its apparent insignificance has led to neglect in reporting cases and as a result there are actually less cases in the literature than of the much less common tumors. Cooper (10) recognized it clearly, described its symptoms, course and prognosis, and knew it as a common occurrence. He called it "alveolar tumor." Velpeau (54) also was under no delusions. He said that it is easily differentiated from carcinoma and saw many cases. Langer (28), Schuchardt (46), Woodyatt (58) and numerous others fully investigated this field and were aware of the frequency of this disease. Other noteworthy contributions to the literature of this subject have been made by Adler (1), Albers (2), Franck (15), Hobbs (22), Ingleby (23), Israel (24), Jones (25), Leveque (29), Maupin (31), Mohr (32), Mueller (34), Speese (50), Stern (51), Whelan (56), and Zappert (60).

The following series of cases from my (Andrews) own practice leaves no doubt in my mind. I have never seen a malignant tumor of the male breast, but am able to report 20 of these benign enlargements, most of which would have appeared trivial if I had not been

[1] Read before the Chicago Surgical Society, April 2, 1926.

especially interested in the subject. I first became interested in this subject in 1919 while in the service.

CASES 1 to 5. In a ward full of patients with old bone sinuses and other suppurative wounds, 5 cases appeared within a week. All were exactly alike. The onset was sudden. Pain and fever were minimal. Soreness to touch was marked. Small flat tumors, varying in size from 3 to 6 centimeters, were palpable under each nipple. One had axillary glands involved to a slight extent. In each case symptoms persisted for 4 to 6 weeks and gradually disappeared. In 1 case a slight secretion appeared when the nipple was squeezed, which yielded a few colonies of staphylococcus albus on culture. There was no evident cause for this sudden epidemic of mastitis except the general condition of the ward. One boy had acute gonorrhœa of 3 weeks' duration when the mastitis appeared.

CASE 6. E. L. A., aged 57, 4 weeks after an operation for empyema, when he was at home and the wound had nearly healed, noticed a small flat button under the right nipple. No rise in temperature occurred and the axillary glands were not involved. The white count, 11,000, could be accounted for on the basis of pleural suppuration. The duration was 8 weeks with gradual disappearance. (Private case.)

CASE 7. A male, aged 54, seen in Michael Reese dispensary, was exceedingly dirty and said he had not bathed for 2 months. A flat smooth, round nodule was located under the nipple, with no gland involvement and no pain. The patient felt a lump, which was rather tender, and came on that account. He was not seen again but the follow-up report at the end of 10 weeks said that the pain and swelling were gone.

CASE 8. R. D., a male over 60 years of age, had undergone a severe gall tract operation, cholecystectomy and choledochotomy, at Mercy Hospital. A tender aching button appeared in the breast on the sixth day and lasted 6 weeks. (Private case.)

CASE 9. J. F., aged 18, came to the dispensary with filthy clothing. A large button under the right breast the size of a half dollar was very tender and ached considerably with marked adenopathy. The symptoms lasted 7 weeks. There was a possible history of injury.

CASE 10. A male, aged 30 years, entered the surgical ward of Michael Reese hospital with a simple fracture of the right radius. A small, rather tender, flat tumor under the nipple was causing no pain and no gland involvement. The patient had noticed the lump 2 weeks before the injury. The lump resolved in one week under hot boric dressings.

CASE 11. M. R., aged 74 years, came for prostatectomy at Mercy Hospital. A flat breast tumor 1 inch in diameter appeared on the sixteenth day and lasted 9 weeks. Although the tumor was not larger than the others, nor were the axillary glands involved, it ached violently for about 2 weeks. (Private case.)

CASE 12. V. L., a janitor, aged 62 years, was well except for old healed tuberculosis of the lungs. A double swelling of the breasts, not very painful, with no fever and no gland involvement, lasted 6 weeks on the left side, and 10 on the other.

CASE 13 K. Z., aged 28 years, dispensary case, came for sudden soreness in the left breast. A flat tumor the size of a quarter proved acutely tender. He stayed home and applied hot dressings and the mass disappeared in 1 week. He thought that a slight secretion accompanied healing but was not sure.

CASE 14. A male, aged 47 years, a dispensary case, had a very tender, button-shaped tumor under each nipple, with no spontaneous pain and no gland involvement. Considerable redness about the areola for 2 weeks made us expect suppuration, but the region healed spontaneously in 3 months with no discharge.

CASE 15. L. R., aged 39 years, with left inguinal hernia, had a small flat button on the left breast. It was very tender but not painful or aching and lasted 6 weeks.

GIRLS

CASE 16. J. S., a girl aged 10 years, was seen with a flat mass the size of a quarter under the left nipple. The pain was severe and some redness of the skin was noted. The pain lasted 3 months. The tumor mass blended into a rapidly developing mamma. The left mamma developed several months ahead of the right. When seen 4 years later the mammæ were perfectly symmetrical.

CASE 17. H. K., aged 9 years, was seen with painful right breast and flat, smooth rounded nodule under the nipple. There was a possible history of trauma. Development of the breast soon obscured the tumor, but the pain lasted 3 months. The history of the left side was similar.

CASE 18. A girl, aged 9 years, was seen with an acutely painful, small flat nodule under the left breast with no gland involvement. The mother was assured that the tumor would blend into the forming mamma, but it disappeared entirely in 6 weeks with no sign of the mamma developing.

GYNECOMASTIA

CASE 19. G. S., aged 28 years, was seen with what appeared to be a typical female breast on the left side of the virgin type. It was painless and had taken about 3 years to develop, having started as a small painful button which became painless as it grew larger. The patient was far from effeminate in type. He was beautifully developed muscularly and earned his living as a professional "strong man." The tumor was excised and found densely adherent to the pectoral fascia. The excised growth was white on section and cut with difficulty, seeming to be fibrous in nature. Microscopic examination showed it to be almost wholly connective tissue with only a very few scattered ducts, with some periductal infiltration of round cells. The pathological diagnosis was chronic inflammatory tissue.

CASE 20. M. R., aged 58 years, was a normal, well developed male, with female type of mamma on the left side. It was painless and had taken 5 years to form. The breast felt harder than a normal female mamma and was somewhat smaller. It was decidedly nodular and irregular on palpation, although on inspection it looked smooth and even. Excision was performed and the mass was found to be adherent to the fascia and muscle so that a part of the pectoralis had to be sacrificed. The patient was seen 4 years later and had had no recurrence.

The histological picture of this tissue (Fig 1) was decidedly not that of adenofibroma, although the clinical course and gross specimen were of that type There was a slight excess of gland tissue compared to the fibrous elements However, the ducts were lined throughout by single layers of epithelium and no budding or proliferation of the epithelium could be seen. The peculiar zone of lighter staining tissue about the ducts was more marked than that seen in normal tissue but it was not beyond the limits of what we have often seen in normal breasts In fact, there was nothing in the slides which would enable one to say that it was not a normal breast, although the epithelial elements were slightly increased. Certain fields showed a slight infection in the tissue as evidenced by clumps of leucocytes about the ducts. This is probably a case on the border line between chronic mastitis and adenofibroma.

Many of the cases reported here may appear too trivial to deserve notice in medical literature. The important point, however, is that these small masses are very frequently mistaken for carcinoma and serious operations are done. Radical mammectomy in the male done unnecessarily is bad enough but in little girls it is a catastrophe. In 11 of my 20 cases the patients had been told by other physicians that mammectomy was necessary to save their lives. Aside from the crime of depriving a girl of all possibility of developing one or more breasts it must be remembered that mammectomy in the male is a difficult operation, as, if a wide excision is made, it is impossible to close the wound and skin grafting must be resorted to. In the 2 cases in which I resected for cosmetic reasons, the involvement of the deeper structures might well have given rise to the fear of malignancy and caused one to make very radical mammectomy.

Thus Patteson (38) removed both breasts from a little girl which are described as giving a typical history of adolescent mastitis. Microscopic reports of this tissue confirm this statement. Adler (1) also had a similar experience and says that these tumors in youths should be left alone. The literature of adolescent mastitis is full of such occurrences and often microphotographs are published showing these innocent tumors.

### SYMPTOMS OF MASTITIS

Mastitis, by far the commonest swelling of the non-functional breast, is characterized by the more or less sudden appearance of a small, flat, button-like mass under the nipple. These tumors vary from 2 to 5 centimeters in diameter. They are uniformly rounded, movable on the underlying fascia, but attached to the skin at the nipple. The nipple is often erect and the mass may be slightly cone-shaped. Fever is minimal (99 to 100 degrees F.), but is generally present during the very early stages. Leucocytosis is not marked enough to be of any value in the diagnosis. These little masses are quite tender to touch but only a minority of them give rise to any spontaneous pain. In some cases the patient has a vague touchiness about the breast for a number of days before he notices any tumor. Secretion is rare and minimal. In a few of our cases a little yellowish serum could be expressed, spontaneous discharge almost never occurred. Axillary glands are not generally involved and never to any serious extent. They are quite tender when they do swell, and this tenderness and swelling lasts but a few days. The infection always runs the same course, lasting usually 1 to 3 months and subsiding gradually.

The etiology of this condition has been obscured by its name, adolescent mastitis. To be sure it often occurs during adolescence, but it is by no means confined to this period. In my cases the condition occurred at all ages and the same is true of those reported in the literature. In those cases seen in men, it is very striking that all the patients belonging to the upper stratum of life got the mastitis as a complication of a septic wound in some other portion of the body. The condition seemed to be idiopathic only in the cases seen in dispensaries or public wards and most of these were in patients with filthy habits and clothing. The fact that so many were cases of double mastitis also supports the view that the infection is derived from the skin surface.

Fig. 1. Section of tumor from Case 20. Very little increase in epithelial elements. Some periductal inflammation. Compare with Fig. 5. (×60.)

My 5 cases noted in military service are paralleled by the experience of Garin and Goullard (17), who noted 5 cases among 800 soldiers with malaria. In 2 of these the mastitis spread to the opposite side. In all likelihood the unsanitary conditions of military life are the important element and not the malaria, as these authors suggested. Jones (25), Leveque (29), and Maupin (31) have also noted a considerable number of cases among soldiers. Tuffier (53) suggested pulmonary tuberculosis as a possible factor and mentions 2 cases. Roger (45) also suspected tuberculosis and pleurisy as factors, but the excised glands showed no evidence of tubercles. Allot (3) had a similar experience. One of my cases occurred following empyema, but again we must look for sepsis as the common factor.

Influence of the sex glands was suggested early. Sir Astley Cooper (10) mentions a man with atrophy of one testis and a tumor of the breast. Prostatectomy, suggested as a factor by Kondoleon (27) and later by Zuckerkandl (61) also occurred in 1 of my cases, but here again the suppurating bladder wound is probably the real explanation. Microscopic examination of excised glands can support no other view. Franck's (15) idea of masturbation seems to have no more support than the popular conception of the relationship of the mamma to the sex glands. The soldiers I saw with mastitis did not at first inform me of their conditions, because they thought it was a venereal disease. Besley (7) reported a case of double mastitis and suggested some ductless gland syndrome as the cause, and Bayley-deCastro (6) also published a case of double mastitis with pain in the testicles.

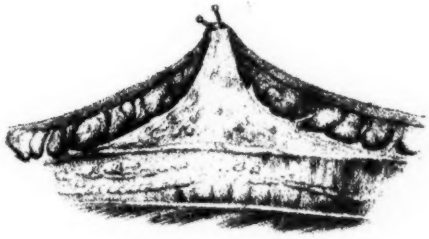

Fig. 2. Normal male mammary gland. (From Cooper.)

Sepsis from within seems to be a very rare etiological factor in these cases. Almost every one reported in which any real etiological factor can be found has had either a suppurating wound or a very dirty skin. Hæmatogenous infection would, therefore, seem to be a negligible factor although of course it cannot be entirely ruled out. Mastitis does not occur as a complication of septic conditions unless the septic material is applied to the skin over the breast.

With this point in mind, investigations were begun to ascertain the opportunity for entrance of infection from without. Most of the anatomical textbooks give a very erroneous impression of the anatomy of the male gland. Spalteholz (48) says it contains only rudiments of gland structures. Jordan (26) says the male breast suffers regressive changes persisting only in a rudimentary condition.

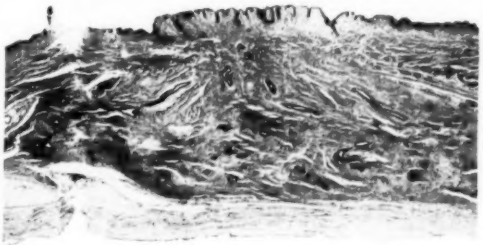

Fig. 3. Cross section of normal male mammary gland. (×8.)

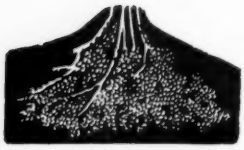

Fig. 4.

Fig. 4. "Quicksilver injection" of ducts of normal male mammary gland. (From Cooper.)

Figure 5. Section of normal male mammary gland. (×60).

Fig. 6. Inflammatory area in normal male mammary gland. These areas are encountered very commonly in our work.

Fig. 5.

Fig. 6.

Quain (42) does not mention the male breast; Gray (19) says it is rudimentary, as does Testut (52), although the latter devotes a little space to a discussion of its histology. Most of the other standard anatomical works dodge the issue and the student is left with the impression that the male breast contains only scraps of gland tissue. Poirier and Charpy (41) in their *Traité d'anatomie humaine* give the best description among modern works.

Cooper (10), however, made many careful dissections and reported that the tumor contained all the elements of the female breast and varied from it only in degree. The accuracy of these fine dissections is proved by the fact that he noted a single anastomosis between ducts and said it was the only one he found in all his dissections. Our models confirm the rarity of this condition. The accompanying cut shows the gross anatomy better than any modern work (Fig. 2). Figure 3 is a cross section of our own case. The tumor is a flattened or low conical structure 2 to 5 centimeters in diameter at its base, generally slightly smaller than the areola. Its inner surface is attached to the subcutaneous fascia which makes up its posterior covering. Anteriorly it is also enveloped in a dense but not sharply defined capsule which blends with the deeper layers of the skin around the mammilla. Cooper also made "injections of the ducts with quicksilver." Figure 4 illustrates the results of this work, which our models demonstrate to have been mostly the products of the imagination of the artist. However, the idea behind it all is fundamentally correct, that is, that there exists in the male breast an exceedingly complicated system of open ducts far from vestigial in nature. This is contrary to the teachings of most anatomists.

Sections were made of normal male breasts taken from subjects of all ages. They reveal that in every male breast there is a very complex series of ducts and alveoli (Fig. 5). They are lined by a single layer of columnar epithelium and are invariably patent. The ducts lie embedded in rather dense connective tissue. The capsule is not sharply defined and blends with the adjacent fibrous tissue, but is nevertheless a limiting membrane through which none of the ducts extend. There is a rather sharply differentiated periductal tissue which consists of less deeply staining fibers containing a greater number of nuclei. This periductal zone bears a close resemblance to growing tissue and has been mistaken for proliferating fibrous tissue (Fig. 5). In many of our normal preparations, we have found small areas of infection marked by the presence of leucocytic infiltration about the ducts. Such areas also bear a very close resemblance to the cases reported as mastitis (Fig. 6).

Serial sections of a number of breasts of men of all ages have been cut and wax models are being prepared. So far as the work has progressed it is quite evident that in many adult males the breast tissue persists in essentially the same state as in the pre-adolescent

female. The model illustrated (Fig. 7) is from a boy of 15, but numerous sections of middle aged and old men show that as much, or nearly as much, glandular tissue may persist in later life. This model reveals a structure of the breast quite comparable with that of a girl of 10. Every duct pictured is patent and each has an opening through the outer skin. With such a complicated set of ducts open to receive infection, with little or no secretion, and with contents therefore in a state of constant stagnation, one wonders not at the occasional infection of such a system, but at the relative infrequency of such a happening.

### PATHOLOGY

Woodyatt (58) classified these benign breast swellings under four heads: (1) simple mastitis, (2) gynecomastia, (3) adenofibromata, and (4) adolescent mastitis. He suggested the possible relationship of adenofibroma and adolescent mastitis. Schuchardt (46), who wrote a very important paper on this subject, also suggested this relation, but neither Schuchardt nor Woodyatt arrived at any very definite conclusions. From our studies, both anatomical and pathological, we would be much more positive, and we regard most of these diseases as different stages or manifestations of one and the same process. The following expresses our views of the development of these benign breast lesions.

1. *Simple mastitis.* In a few cases, suppuration actually occurs at the onset of mastitis. This, however, is quite rare. If suppuration is going to take place it always occurs early. There are no reports of suppuration in long-standing mastitis cases. Abscess of the male breast has been reported by Bailey (5). His case, like most others, was a complication of the secretion in the breast in the newborn, often called "witch-milk."

2. *Chronic mastitis* (adolescent mastitis, alveolar tumor). This entity as described above is the result of by far the greatest number of breast infections. Pathologically its characteristics are variously given. The microphotographs given in the literature on this subject are not convincing. One person will call mastitis what the next calls adenofibroma. Inflammatory tissue is not abundant. Round cell infiltration about the ducts is a frequent finding but is never very marked. There is often reported an increase in the fibrous elements, but this also is not marked. Vascularity is increased. Lastly, one must note that these glands are but little larger than normal ones, and that all the points in the pathological picture can be found to a lesser degree in the normal breast (cellular infiltration, new tissue about the ducts). In all probability what occurs is that a slight infection is simply causing an œdema of the densely fibrous structure and this tension is the cause of the pain and tenderness. The possible results are that (*a*) resolution occurs in the vast majority of cases; (*b*) if any disease process results, it is usually adenofibroma; (c) gynecomastia rarely occurs; and (d) cysts are the least common result.

Adenofibroma has frequently been observed to develop on an old mastitis. One of my cases ran such a course. Whelan (56) reports an adenofibroma occurring 8 years after an attack of mastitis. Gangitano (16) reports 2 such cases. Griffin (20) saw, in a male patient, adenofibroma of both breasts following double mastitis. The pathological picture in mastitis is very similar to that seen in adenofibroma. The only real differentiating point is the development of multiple layers of epithelial cells in the ducts, or the formation of solid plugs of such cells. These features are lacking in most of the reported cases, and also can occasionally be demonstrated in normal breasts. There is said to be an increase in connective tissue in adenofibroma, but if sections are carefully compared with a series of normals, this point is extremely doubtful. Finally most cases of adenofibroma also show considerable periductal inflammation. However, there really are cases in which the epithelial proliferation is more marked; and it would be well to confine the use of this term to those cases in which there is a piling up of layer after layer of epithelium in the ducts, as in the case reported by Woodyatt. In these tumors the condition so closely resembles mastitis that any real differentiation is generally impossible. The difference is a matter of degree rather than kind, the growth usually being larger in the case of the tumors. One may

say that operation is only justifiable if the growth is large enough to be troublesome or embarrassing to the patient, or if the condition has persisted long enough for an ordinary mastitis case to resolve, at least 4 months. I know of no case in which cancer has developed on an adenofibroma. Owens and Eisendrath (35) also note that malignant degeneration of these tumors is very rare.

Gynecomastia, as we have already noted, is a misnomer. In this condition the breasts are not hypertrophic and contain a minimum of glandular elements. The disease often follows mastitis and appears to be simply an irritation or infection in which the fibrous elements tend to predominate. Sections from one of my cases (Case 19) showed practically no gland tissue. The other section seemed to bear a very close resemblance to normal breast tissue although there was an increase in the fibrous elements. The numerous reports in the older literature of milk secretion by the male breast cannot be accepted. Since the introduction of modern critical methods no such case has appeared. As Woodyatt suggested, in view of the histological evidence against this phenomenon, one cannot accept such a fact without chemical verification by tests for lactose and colostrum bodies. In our studies these conditions have never been seen. However, in the older literature it is curious to note in how many cases drainage of pus or serous material has been mistaken for lactation. Even Poirier and Charpy say that lactation has been observed in men, especially in negroes. They refer to Busch's work which we have not been able to locate. A good example of the type of evidence offered in such cases is the report of the explorer Humboldt, who saw a male negro with gynecomastia. This negro told him that 5 years previously, he had nursed his child. However, there is little or no evidence of female characteristics in patients with gynecomastia. Bailey (5) mentions the case of a Zulu chief with this disease who had 40 wives and over 100 children. In view of all this, the microscopic picture of chronic inflammation with a minimum of ducts and the lack of any chemical verification make a strong case against the existence of a true gynecomastia.

This disease cannot be called a fibroma as it does not grow as an encapsulated single tumor. It is rather an overgrowth of the connective tissue in the breast with smaller amounts of epithelial elements, brought about as a reaction to chronic infection. These tumors also are benign and never undergo malignant degeneration. They can be differentiated from the adenofibromata by their smoothness and resemblance to the female breast while the others are inclined to be lobular.

Cysts of the male breast are rare. They are often the result of an old mastitis, and are probably due to the obstruction of a duct by inflammatory tissue. They should be removed at once as they are very much inclined to undergo malignant changes. Peachell (39) reports such malignant degeneration of a cyst and says it is quite common. A cyst excised by Peck (40) puzzled three pathologists. It probably was an inflammatory duct obstruction.

### DIFFERENTIAL DIAGNOSIS

The differential diagnosis between mastitis and malignancy is not difficult. In the first place mastitis occurs at all ages while carcinoma is a disease of old age. Fessler (13) collected 700 cases and said that most of them occurred after the age of 57 years. This is, of course, distinctly older than the average age in women. Carcinomata are inclined to ulcerate at a very early stage. Speese (50) says this occurs in 30 per cent of cases. Schuchardt (46) found ulceration in 61 out of 219, Williams (57) in 9 of 26; Warfield (55) in 13 of 37; and Manger (30) in 18 of 71. The axillary glands are generally involved (65 per cent, Speese), a rare complication in mastitis and even then being of but a few days' duration. Pain is marked in cancer. It occurs early. The tumor is soon fixed to the underlying fascia. It involves the skin from the beginning and has very early skin metastases. Induration of the areola is marked. With all these differential points there should be no difficulty in distinguishing between carcinoma and mastitis. If one is in doubt, of course, operation is the only choice but such a condition must indeed be rare.

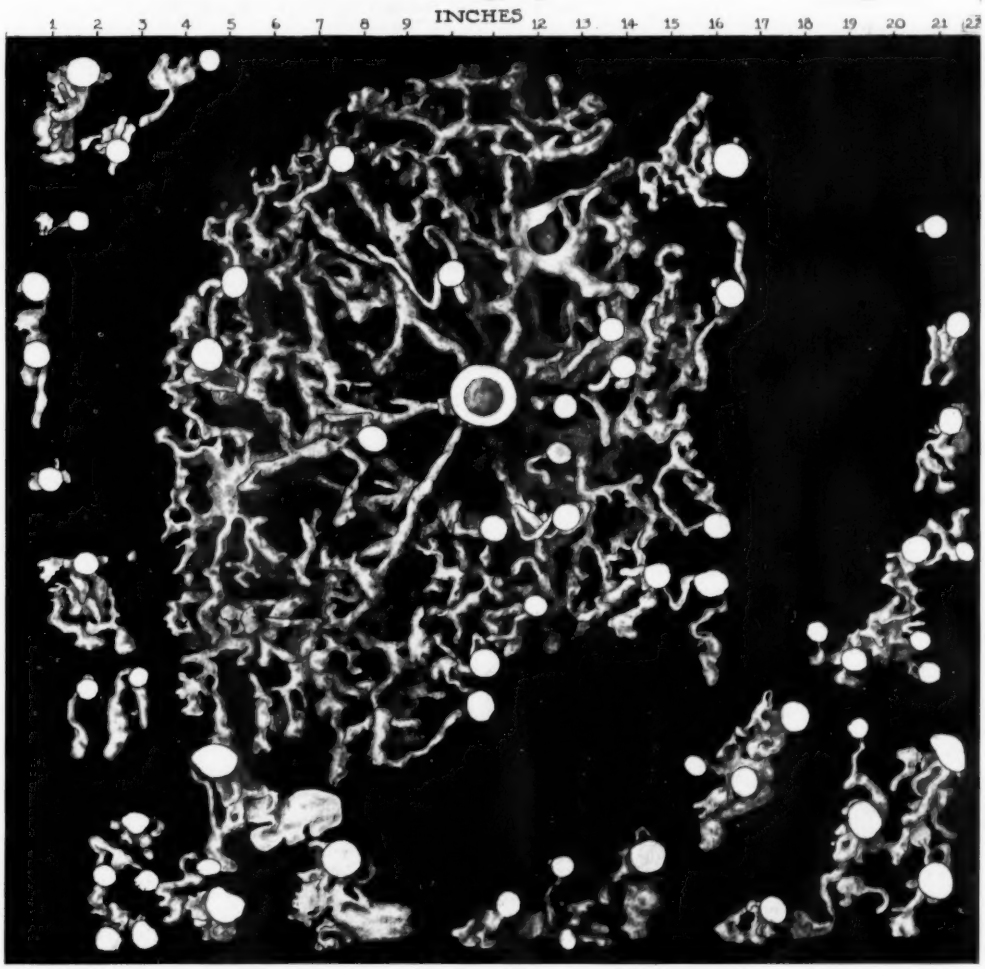


Fig. 7. Wax model made from serial sections of normal male mammary gland (15-year old boy).

TREATMENT OF MASTITIS

Treatment is in a large measure palliative. As the disease is self limited, the therapy is not of great importance. Two of my cases which were hospitalized for other purposes seemed to recover in a shorter time than usual under hot wet dressings. (Case 13 lasted but 1 week and Case 10 but 3.) However, in many other cases hot wet dressings had no effect whatsoever on the course of the disease. Velpeau (54) advocated maceration in the hope of promoting drainage and quoted Robelin (43) as saying that compression was valuable. It seems to us that the discomfort incident to maintaining such treatment is hardly warranted by the slight importance of the lesion. The application of antiseptics cannot be of value as it is idle to suppose that they could penetrate to the infected area. Probably these forms of therapy should be reserved for those rare cases in which pain is enough to justify the trouble, and for those

already hospitalized for some other cause. In the vast majority, small doses of salicylates are all the treatment needed.


## SUMMARY

1. Contrary to the usual teaching, benign swellings of the male breast are much more common than malignant ones.

2. Adenofibroma and gynecomastia are the result of chronic infection.

3. The male breast is far from rudimentary, containing even in old age an elaborate system of patent ducts opening onto the skin which are evidently quite liable to infection from without.


## BIBLIOGRAPHY


1. Adler, D. Med. Wchnschr., 1901, xxvii, 72.
2. Albers. Med. Korrespond.-Bl. Rhein. u. Westphael. Aerzt., 1843, No. 13.
3. Allot. Thèse de Par., 1887.
4. Ashhurst. Encyclopedia of Surgery, 1895.
5. Bailey. Lancet, 1924, i, 1258.
6. Bayley-deCastro. Indian M. Gaz., 1916, li, 420.
7. Besley. Surg. Clin. Chicago, 1917, i, 170.
8. Billroth. Allg. Chir. Path. u. Chir., 1893; also Klin. Chir., Wien, 1871, p. 269.
9. Carson. Bryant and Buck's System of Surgery.
10. Cooper. Anatomy and Diseases of the Breast. Philadelphia, 1845.
11. Da Costa. Modern Surgery.
12. Deaver. The Breast, Its Anomalies, Diseases and Their Treatment. Philadelphia, 1917.
13. Fessler. Deutsche Ztschr. f. Chir., lxxii, 429.
14. Finney. Keen's Surgery.
15. Franck, D. Med. Wchnschr., 1901, xvii, 169.
16. Gangitano. Deutsche Ztschr. f. Chir., 1909, ciii, 1.
17. Garin and Goullard. Lyon Med., 1917, cxxvi, 410.
18. Gibson. Ann. Surg., 1912, lv, 636.
19. Gray. Anatomy. Philadelphia, 1908.
20. Griffin. Bull. Johns Hopkins Hosp., 1909, July, p. 218.
21. Henry. Quoted by Gross.
22. Hobbs. Bull. Soc. d'anat. et physiol. de Bordeaux, 1895, xvi, 154.
23. Ingleby. Brit. M. J., 1919, ii, 531.
24. Israel. Inaugural Dissertation, Berlin, 1894.
25. Jones. J. Roy. Navy Med. Serv., 1917, iii, 109; 1920, vi, 471.
26. Jordan. Textbook of Histology. New York: Appleton, 1916.
27. Kondoleon. Zentralbl. f. Chir., 1920, xlvii, 1098.
28. Langer. Denkschr. d. k. Akad. d. Wissensch., 1852 iii.
29. Leveque. Bull. Soc. de méd. mil. franç., 1912, vi, 177.
30. Manger. Dissertation, Jena. 1901.
31. Maupin. Bull. Soc. de méd. mil. franç., 1912, vi, 327.
32. Mohr. Deutsche med. Wchnschr., 1903, xxix, 431.
33. Muelleder. Arch. f. klin. Chir., 1922, cxx, 686.
34. Mueller. Deutsche med. Wchnschr., 1905, xxxi, 21.
35. Owens and Eisendrath. Chicago M. Rec., 1898, xv, 149.
36. Paget. Diseases of the Breast.
37. Palermo. Quoted by Speed (49).
38. Patteson. J. Anat. & Physiol., 1892, xxvi, 509; also Brit. M. J., 1899, i, 725.
39. Peachell. Lancet, 1906, December 15, p. 1660.
40. Peck. Ann. Surg., 1903, xxxviii, 450.
41. Poirier and Charpy. Traité d'Anatomie Humaine.
42. Quain. Textbook of Anatomy.
43. Robelin. Thèse de Par., 1852.
44. Rodman. Ann. Surg., 1912, lv, 636; also Diseases of the Breasts, Philadelphia, 1908.
45. Roger and Garnier. Compt. rend. Soc. de biol., Par., 1899, 11th ser. i, 647.
46. Schuchardt. Arch. f. klin. Chir., 1885, xxi, 159.
47. Shields. A Clinical Treatise on Diseases of the Breast. 1898.
48. Spalteholz. Textbook of Anatomy.
49. Speed. Ann. Surg., 1925, lxxxii, 45.
50. Speese. Ann. Surg., 1912, lv, 530.
51. Stern. Ztschr. f. ang. Anat., 1920, vi, 367.
52. Testut. Traité d'Anatomie Humaine, Paris.
53. Tuffier. Quoted by Roger.
54. Velpeau. A Treatise on Diseases of the Breast. Paris, 1853.
55. Warfield. Bull. Johns Hopkins Hospital, 1901, xii, 305.
56. Whelan. Brit. M. J., 1909, i, 1006.
57. Williams. Lancet, 1889, September 10, p. 261.
58. Woodyatt. Am. J. M. Sc., 1909, cxxviii, 244.
59. Yamamato. Dissertation, Rostock, 1911.
60. Zappert. Ztschr. f. Kinderh., 1912, iv, 353.
61. Zuckerkandl. Zentralbl. f. Chir., 1920, xlvii, 1313.

# PLACENTA PRÆVIA; A STUDY OF ONE HUNDRED AND SIXTY-FIVE CASES[1]

By GEORGE L. BRODHEAD, A.B., M.D., New York
Visiting Obstetrician, Harlem Hospital
AND
EDWIN G. LANGROCK, M.D., New York
Assistant Visiting Obstetrician, Harlem Hospital

BEFORE proceeding to the discussion of the treatment of placenta prævia, let us consider first the definition of the three varieties: central, marginal, and lateral. Technically and strictly speaking, a central placenta prævia is one which covers the entire internal os at the time of full dilatation; a marginal type is one, the margin of which is felt at the internal os when the cervix is incompletely dilated; and the term lateral placenta prævia refers to a placenta the edge of which may be felt at the internal os when the cervix is completely, or almost completely, dilated.

Obviously, it is difficult in some cases, when the cervical dilatation is 1 to 2 fingers, to determine whether one is dealing with a central or marginal placenta prævia.

In our paper, the classification of placenta prævia has been made from the clinical standpoint, for it is upon this viewpoint that the treatment of the condition is necessarily based.

A word of caution should be added before the treatment of placenta prævia is taken up. When placenta prævia is suspected, and when we know that a profuse hæmorrhage may follow a digital examination, preparation should be made for the introduction of a firm tampon of gauze to check bleeding until full preparations can be made for delivery.

## TREATMENT

The treatment of placenta prævia must depend to a considerable extent upon age, parity, period of gestation, type of placenta prævia, extent of cervical dilatation, condition of the patient and infant, number of living children, the environment of the patient, and the surgical experience of the operator.

When the cervix is sufficiently dilated to admit the hand, version is usually the best operation in both primiparæ and multiparæ with lateral or marginal placenta prævia. Extraction of the child should be very gradual, unless the cervix is fully dilated.

The introduction of the modified de Ribes bag without rupture of the membranes is generally indicated in cases of marginal or lateral placenta prævia with little cervical dilatation. Emphasis must be laid upon the fact that when the bag has been expelled from the uterus into the vagina, as evidenced by a sudden cessation of pains, hæmorrhage is no longer controlled. If a small bag has been used, a large bag should be introduced immediately. If a large bag has been used, the patient should be immediately delivered by version.

The forceps operation is used in any type of placenta prævia when the vertex is in the pelvis and the cervix is almost, if not fully, dilated.

Rupture of the membranes is indicated only in patients with marginal or lateral placenta prævia, when bleeding is slight and the cervix is fully dilated.

Packing is a method of treatment which is preferred by many excellent obstetricians. We believe, however, that the modified de Ribes bag is a better dilator and checks hæmorrhage equally well.

Pituitrin in small doses of 2 to 3 minims is a valuable adjunct when uterine contractions are weak and when progress is slow.

Manual dilatation of the cervix in placenta prævia is a frequent cause of laceration, and should be condemned as a dangerous procedure.

Cæsarean section has a limited but well defined place in the treatment of placenta prævia. In all primiparæ, at or near term, with central placenta prævia and undilated cervix, section offers the best result, provided the operation can be performed under favor-

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able circumstances by a competent surgeon. This holds true also in multiparæ at term with central placenta prævia when the patient elects to take a slight additional risk to obtain a living child.

Taking up now for consideration what we may term the debatable cases, let us consider first patients pregnant for from 7 to 9 months who, when first seen, have a cervical dilatation of 2 to 3 fingers, and who are in poor condition from loss of blood. Six of our 18 fatal cases were patients of this type, and the question arises: Would not cæsarean section have been a better plan of procedure? A rapid section with through-and-through sutures of the uterus and abdominal walls might give better results. The operation requires less time than completing the dilatation of the cervix followed by version and extraction and is attended as a rule with small blood loss. Judging from a limited experience with cæsarean section for profuse bleeding in cases of accidental hæmorrhage, we find it may be the operation of choice.

Cæsarean section has been chosen by some obstetricians as the best method of delivery for both primiparæ and multiparæ pregnant 6 to 8 months, with central placenta prævia and cervical dilatation of 1 to 2 fingers. We agree that in central placenta prævia in a primipara with an undilated cervix, section is advisable; but in multiparæ we believe that section is debatable.

We have collected and studied 39 cases of central placenta prævia and find that there were 11 maternal deaths, 2 in primiparæ and 9 in multiparæ, giving a gross mortality of 28 per cent.

One patient was moribund on admission to the hospital, the cervix was fully dilated, and the breech presenting. Breech extraction was at once performed and the patient died one hour after admission to the hospital.

Another patient was admitted to the hospital moribund, a Hicks version was done, and she died 1 hour later undelivered.

In a third patient admitted to the hospital moribund, the cervix was very thin and 4 fingers dilated. Podalic version was easily done, but the woman died one hour postpartum.

We mention these cases not only to explain to a certain extent the high mortality, but also to emphasize the fact that treatment for this condition should have been instituted hours before the patients were admitted to the hospital.

Let us now study the cases of central placenta prævia in women pregnant 6 to 8 months who were treated mainly by bag and version but in a few instances by manual dilatation and version.

There were 17 multiparæ, 3 primiparæ, and 2 of unknown parity, a total of 22. The 2 women of unknown parity were saved by bag and version. The 3 primiparæ lived, cæsarean section being performed on 1. In the 17 multiparæ, 2 were treated by cæsarean section and lived; 4 of the other 15 who were treated by bag and version died, giving a mortality of 26 per cent.

To summarize: in 22 cases, 3 were treated by section and lived; 19 were treated by bag and version or manual dilatation and version, and 4 died, with a total mortality of 20 per cent.

The number of cæsarean sections reported in this series is too small for a definite conclusion to be drawn therefrom, but the mortality of 26 per cent in the 15 women who were not treated by section is so large that we believe section, in at least some of these cases, may be the operation of choice.

Following any mode of delivery, we believe that in these cases the uterus and vagina should be tightly packed with iodoform gauze as a routine procedure, both for control of the active bleeding and to prevent, as far as possible, subsequent hæmorrhage.

Blood transfusion is of the very greatest benefit to many of these patients and typing should be done as soon as possible after the first bleeding in order that preparations may be quickly made for transfusion which may be necessary at a moment's notice.

We have collected the records of 165 cases from our hospital and private work, but the large majority have been seen in the obstetrical service of the Harlem Division of Bellevue Hospital. The fact must be kept in mind that our Hospital is a free city institution where patients are not infrequently admitted in a moribund condition when it is too late for help to be given. The statistics of private cases,

TABLE I.—AGE INCIDENCE

| Years | Primip-aræ | Multip-aræ | Parity unknown | Total |
|---|---|---|---|---|
| Under 20 | 3 | 2 | .. | 5 |
| 20 to 25 | 11 | 21 | 1 | 33 |
| 26 to 30 | 16 | 26 | 1 | 43 |
| 31 to 35 | 1 | 28 | .. | 29 |
| 36 to 40 | 1 | 33 | 1 | 35 |
| Over 40 | .. | 9 | .. | 9 |
| Unknown | 1 | 8 | 2 | 11 |
| Total | 33 | 127 | 5 | 165 |

TABLE II.—PERIOD OF GESTATION

| Months | Primip-aræ | Multip-aræ | Parity unknown | Total |
|---|---|---|---|---|
| 5 to 7 | 2 | 13 | 2 | 17 |
| 7 to 8 | 10 | 32 | 2 | 44 |
| 8 to 8½ | 8 | 29 | 1 | 38 |
| 8½ to 9 | 13 | 41 | .. | 54 |
| Unknown | .. | 12 | .. | 12 |
| Total | 33 | 127 | 5 | 165 |

especially of patients who can be confined in a hospital, should be very much better than those we shall give.

### MATERNAL MORTALITY

Case 1. A vi-para at 8 months with a marginal placenta prævia was treated by version. The causes of unavoidable death in this case, on the eighth day, were tuberculosis and inanition.

Case 2. An viii-para at 7½ months with central placenta prævia, exsanguinated when first seen, was treated by manual dilatation and version. We believe that a case of this type should be treated by cæsarean section, performed as rapidly as possible, with through-and-through sutures of the abdominal wall to save time.

Case 3. A ii-para of unknown period of gestation and unknown type of placenta prævia was treated by the de Ribes bag and version. The patient died 2 hours after delivery from shock, bleeding, and exhaustion. The plan of treatment used in this case, in spite of the unfortunate outcome, is the usual mode of procedure.

Case 4. In a v-para of unknown period of gestation with central placenta prævia and cervix admitting 2 fingers, the patient was treated by a de Ribes bag and version. Considering the type of placenta prævia, the multiparity, and the amount of dilatation when first seen, we believe the patient was treated in the most conservative way.

Case 5. A primipara at term with a central placenta prævia and cervical dilatation of 4 fingers was treated by version. This treatment was conservative though cæsarean section should be considered in a case of this type.

Case 6. A ii-para of unknown period of gestation with marginal placenta prævia was treated by manual dilatation and version. This patient died of sepsis, a most unfortunate and unavoidable complication.

TABLE III.—PARITY, TYPE OF PLACENTA PRÆVIA, AND OPERATION

| | Primiparæ 33 | | | | Multiparæ 126 | | | | Unknown 3 | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Marginal | Central | Lateral | Unknown | Marginal | Central | Lateral | Unknown | Marginal | Central | Lateral | Unknown | |
| Bag introduction | 3 | | | | 7 | 1 | | | | | | | 11 |
| Bag and breech extraction | 2 | | | | 1 | 1 | 2 | | | | | | 6 |
| Bag and version | 8 | 1 | | | 25 | 10 | 4 | 2 | | | | | 50 |
| Breech extraction | 1 | | | | 4 | | 3 | | 1 | | | 1 | 10 |
| Cæsarean section | 3 | 2 | | | | 4 | | | | | | | 9 |
| Craniotomy | | | | | 1 | | | | | | | | 1 |
| Forceps | | | | | 3 | | 1 | | | | | | 4 |
| Instrumental dilatation and version | | | | | | 1 | | | | | | | 1 |
| Manual dilatation and breech | | 1 | | | | | | | | | | | 1 |
| Manual dilatation and version | 1 | | 1 | | 6 | 2 | | | | 1 | | | 11 |
| Normal | | | | | 4 | 1 | 3 | 1 | | | | 1 | 10 |
| Packing and normal | | | | | 3 | | | | | | | | 3 |
| Packing and version | | | | | | 1 | | | | | | | 1 |
| Pituitrin and normal | | | | | 1 | | | | | | | | 1 |
| Rupture of membranes, bag and pituitrin | 2 | | | | | | | | | | | | 2 |
| Rupture of membranes and pituitrin | 1 | | | | | | | | | | | | 1 |
| Version (podalic) | 2 | 2 | | | 12 | 5 | 5 | 1 | | 1 | | | 28 |
| Version (Hicks) | 2 | 1 | | | 5 | 3 | 1 | | | 1 | | | 13 |
| Version (partial podalic) | | | | | 2 | | | | | | | | 2 |
| Totals | 25 | 7 | 1 | | 74 | 29 | 19 | 4 | 1 | 3 | | 2 | 165 |

| | | | |
|---|---|---|---|
| Marginal | 100 | Version | 106 |
| Central | 39 | Normal delivery | 28 |
| Lateral | 20 | Breech extraction | 17 |
| Unknown | 6 | Cæsarean section | 9 |
| | | Forceps delivery | 4 |
| Total | 165 | Craniotomy | 1 |
| | | Total | 165 |

Case 7. A multipara at term with central placenta prævia was treated by a de Ribes bag and version. Because of the parity of the patient, the use of the bag followed by version was the conservative plan of treatment. This patient bled to death because of continued hæmorrhage from the placental site, which might have occurred even though cæsarean section had been the procedure chosen. At autopsy no cervical laceration or uterine rupture was found.

Case 8. A iii-para at 6 months with a marginal placenta prævia was treated by manual dilatation and version. In our opinion the operation of manual dilatation and version is usually unwise and extremely dangerous. Our rule in a case of this type and at this period (6 months) is invariably the use of the modified de Ribes bag.

TABLE IV.—FETAL MORTALITY; PERIOD OF GESTATION

| Months | Primiparæ | Multiparæ | Unknown | Total |
|---|---|---|---|---|
| 6 to 6½ | 1 | 13 | 1 | 15 |
| 6½ to 7 | 2 | 12 | 2 | 16 |
| 7 to 8 | 6 | 23 | .. | 29 |
| 8 to 8½ | 4 | 13 | .. | 17 |
| Term | 7 | 20 | .. | 27 |
| Unknown | .. | 6 | .. | 6 |
| Total | 20 | 87 | 3 | 110 |

TABLE V.—FETAL MORTALITY; TYPE OF PLACENTA PRÆVIA

| | Primiparæ | Multiparæ | Unknown | Total |
|---|---|---|---|---|
| Central | 4 | 20 | 2 | 26 |
| Marginal | 14 | 42 | .. | 56 |
| Lateral | 1 | 9 | .. | 10 |
| Unknown | .. | 3 | .. | 3 |
| Abortion at 6 months | 1 | 13 | 1 | 15 |
| Total | 20 | 87 | 3 | 110 |

TABLE VI.—FETAL MORTALITY; METHOD OF DELIVERY

| | Primiparæ | Multiparæ | Unknown | Total |
|---|---|---|---|---|
| Bag introduction | 3 | 4 | .. | 7 |
| Bag and breech extraction | 1 | 2 | .. | 3 |
| Bag and version | 6 | 22 | .. | 28 |
| Breech extraction | 1 | 4 | .. | 5 |
| Cæsarean section | .. | 2 | .. | 2 |
| Craniotomy | .. | 1 | .. | 1 |
| Forceps | .. | 2 | .. | 2 |
| Instrumental dilatation and version | .. | 1 | .. | 1 |
| Manual dilatation and breech extraction | 1 | .. | .. | 1 |
| Manual dilatation and version | 2 | 3 | .. | 5 |
| Normal | .. | 8 | .. | 8 |
| Packing and breech extraction | .. | 1 | .. | 1 |
| Pituitrin and normal | .. | 1 | .. | 1 |
| Unknown (6 months) | 1 | 13 | 1 | 15 |
| Version (podalic) | 5 | 14 | 1 | 20 |
| Version (Hicks) | .. | 7 | 1 | 8 |
| Version (partial podalic) | .. | 2 | .. | 2 |
| Total | 20 | 87 | 3 | 110 |

| | | | |
|---|---|---|---|
| Version | 64 | Cæsarean | 2 |
| Normal | 16 | Forceps | 2 |
| Breech extraction | 10 | Craniotomy | 1 |
| Unknown (6 months' abortion) | 15 | Total | 110 |

CASE 9. An viii-para at term with central placenta prævia was treated by version. The case was unfavorable in that she had bled profusely before admission to the hospital. Although a conservative podalic version was done, there being no further hæmorrhage during delivery, the patient died of continued bleeding from the placental site. A postmortem revealed an intact cervix and uterus.

CASE 10. A ii-para, pregnant 8 months, in poor condition, with lateral placenta prævia and cervical dilatation of 2 fingers when first seen, was treated by Hicks version, and died 2 hours postpartum of shock and hæmorrhage.

CASE 11. A ii-para, pregnant 6 months, with central placenta prævia and cervical dilatation of 1½ fingers when first seen, was treated by a de Ribes bag and version. The patient reacted fairly well. While transfusion was being done, the patient showed evidence of shock and died.

CASE 12. A ix-para, pregnant 8 months, moribund (pulseless) on admission, with central placenta prævia, thin cervix and dilatation of 4 fingers, was treated by easy version and extraction, and died 1 hour postpartum.

CASE 13. A ii-para, pregnant 8½ months, with marginal placenta prævia and cervical dilatation of 3½ fingers when first seen, was treated by transfusion and version at the same time. After postpartum hæmorrhage through the packing, the packing was replaced, and patient died.

CASE 14. A v-para, of unknown period of gestation, with central placenta prævia, after normal delivery, died suddenly while being prepared for transfusion.

CASE 15. A iii-para, pregnant 7 months, with central placenta prævia and a history of bleeding for 3 days, came to the hospital moribund with cervical dilatation of 2 fingers. Hicks version was used, and the patient died 1 hour later undelivered.

CASE 16. A primipara, pregnant 8 months, in poor condition, came to the hospital with the placenta protruding from the cervix. She was treated by bag and version, and died 6 hours after delivery of shock and hæmorrhage.

CASE 17. A iii-para at term in poor condition came with central placenta prævia and cervical dilatation of 1 finger when first seen. Transfusion was followed by treatment by bag and version. The patient died 2 hours after delivery of shock and hæmorrhage.

CASE 18. A primipara, at term, pulseless on admission, with central placenta prævia and cervix fully dilated, was bleeding profusely. Breech presentation was followed by extraction. The patient died 20 minutes after delivery (1 hour after admission).

In the entire series of 165 cases there were 18 deaths, 3 of the women being admitted to the hospital moribund and 1 losing her life from tuberculosis and inanition.

The gross maternal mortality was 10.9 per cent. Excluding the 4 cases mentioned above, 3 of which were hopeless from the start, the mortality was 8.7 per cent.

# URETERAL STRICTURE IN MALE AND FEMALE

## With Particular Reference to Symptoms and Diagnosis[1]

By HOWARD L. TOLSON, M.D., Cumberland, Maryland

URETERAL stricture is a common pathological condition that should be of interest to every medical man. Patients suffering with this lesion are frequently seen by every active physician whether he be engaged in general medicine, or one of the specialties.

Usually these patients first consult the family physician, and for this reason those doing general medicine should be particularly interested in the symptoms and diagnostic features of ureteral stricture. Pain in the abdomen or back is the most frequent chief complaint, and consequently many patients with ureteral stricture are referred to the general surgeon. On account of pain in the pelvic region, backache, and dysmenorrhœa, many of them go to the gynecologists. Stricture patients usually have an exacerbation of symptoms during pregnancy, and obstetricians have to deal with the condition. Again, the gastro-intestinal disturbances are the most prominent features and the patients are sent to the gastro-enterologists. Pain due to ureteral stricture is often referred to the sacro-iliac, hip, and thigh regions, and therefore the advice of the orthopedists is sometimes sought. The ophthalmologists are often called upon to relieve headache, which is frequently a prominent complaint. Tonsils are the source of infection in a large percentage of ureteral stricture cases, and the services of the laryngologists are necessary to eradicate the focus. Neurologists see many of these patients, who after a long period of suffering have developed neurological symptoms. The ones with renal colic type of pain and prominent urinary symptoms are ordinarily promptly referred to the urologists, who too often on account of the easy passage of plain renal catheters, negative urine findings, and misinterpretation of X-ray films, turn them over to some other specialist.

As in many other conditions, the effects of ureteral stricture are manifested in various parts and systems of the body and the predominating symptoms may be in any of the parts or tracts involved. Prominent symptoms in parts of the body outside the urinary tract have served to direct attention and remedial attack on the effects, and have placed the primary causative pathology so far in the background as to be out of sight in many cases. Even within the urinary tract attention and remedial attack has been largely directed to resulting kidney pathology, such as hydronephrosis, while the primary pathology in the ureter has passed unobserved. The manifestations of ureteral stricture frequently simulate better understood conditions. Moreover, it is quite apparent that a large number of medical men are still unfamiliar with the clinical picture of ureteral stricture, and do not sufficiently appreciate its prevalence and importance. Consequently, it is not surprising to observe that patients with ureteral stricture commonly pass through the hands of many medical men, including surgeons and various specialists, without obtaining relief.

There seems to be a very general impression that the symptoms of ureteral stricture are indefinite, that there are no physical findings that suggest the condition, and that the lesion can be diagnosed only by cystoscopic methods. On the contrary, it is my belief that ureteral stricture has definite symptoms that produce clear-cut clinical pictures; that there are physical findings that suggest the lesion and that a working or provisional diagnosis can be made in most cases without the aid of cystoscopic methods. Certainly the diagnosis of ureteral obstruction which may be due to a variety of conditions can be readily made, and this is sufficiently exact for a provisional diagnosis.

Hunner, in his many papers dealing with ureteral stricture, has so thoroughly covered the subject and its various phases that it is difficult to add anything original. However,

[1] Read before the district meeting of the American College of Surgeons, Virginia, West Virginia, Maryland, and District of Columbia, held at Cumberland, Maryland, March 2 and 3, 1926.

Fig. 1.

Fig. 1. Ureteral stricture, kink, hydronephrosis, ptosis. Kidney pelvis incompletely filled with opaque solution. Ureter dilated above stricture area; patient relieved by ureteral dilatation and nephropexy.

Fig. 2.

Fig. 2. Stricture in pelvic ureter. Ureter dilated above the stricture. Relieved by dilatation.

Fig. 3.

Fig. 3. Hydronephrosis, stricture. Relieved by dilatation.

with the hope of emphasizing the diagnostic features, the data tabulated from the records of 100 consecutively treated cases of ureteral stricture are presented. These cases occurred within a period of about 18 months and were the first 100 ureteral stricture patients treated by me. A period of at least 12 months has elapsed since the first course of treatment was completed. Six patients in this series have since required further dilatation.

In this brief report I wish to deal chiefly with the symptoms and diagnosis of ureteral stricture. Nevertheless, it would probably not be amiss at the outset to define the condition. As defined by Hunner, "Ureteral stricture is an inflammatory condition of the ureteral walls resulting in infiltration and varying degrees of narrowing of the lumen." I might add that in many cases ureteral stricture is rather a sequel of inflammation; the active inflammatory process having subsided by the time the symptoms of obstruction occur, particularly if the infected sinuses, teeth, etc., have had appropriate treatment.

## ETIOLOGICAL FACTORS

*Sex.* In the 100 cases which form the basis of this report, there were 62 females and 38 males. It is, of course, impossible to draw deductions regarding the incidence of the condition in the sexes from such a small series. However, it is probable that these figures approximate the relative incidence in male and female. Inflammatory conditions of the upper urinary tract occur much more frequently in the female, and with the study of large series of ureteral stricture patients the relative incidence of stricture in the sexes will most likely be found to correspond with the relative incidence of inflammatory conditions. Rathbun of Brooklyn reports a series of 92 cases of ureteral stricture; 48 of these were in males and 44 in females. His admittances were about equal.

*Age.* The youngest patient in this series was a female child 13 years of age. The two oldest patients were of the opposite sex and were each 66 years of age. The ages at which the patients were first seen are as follows:

| Age in years | Cases |
|---|---|
| 11 to 20 | 7 |
| 21 to 30 | 46 |
| 31 to 40 | 29 |
| 41 to 50 | 8 |
| 51 to 60 | 6 |
| 61 to 70 | 4 |

Seventy-five of the 100 cases occurred in individuals between the ages of 21 and 40. The condition is most frequently seen in early and mid-adult life, which is probably the period of life when most of the remote results of focal infections manifest themselves.

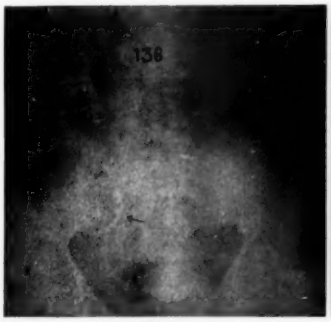


Fig. 4.

Fig. 5.

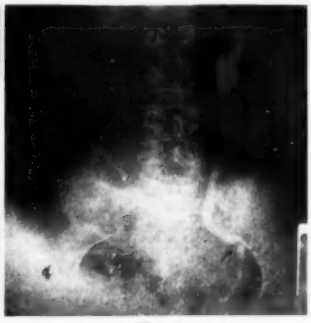

Fig. 6.

Fig. 4. Ptosed kidney, stricture, which was relieved by dilatation.

Fig. 5. Multiple strictures, hydronephrosis, ptosis. Relieved by dilatation.

Fig. 6. Multiple strictures. Renal pelvis is moderately dilated. Two narrow infiltration areas in upper ureter and another just below the pelvic brim. Ureter dilated above the lower stricture. Relieved by dilatation.

*Social status.* Of the 62 females, 41 were married and 27 had gone through one or more full term pregnancies. These figures suggest that pregnancy plays little or no part in the etiology of ureteral stricture. Three of the patients, however, first came for treatment during pregnancy. Their histories indicated that they had had mild degrees of obstruction before pregnancy and that their symptoms had become much aggravated with the physiological changes in the pelvis incident to pregnancy. One of these patients, who went to term and was entirely relieved of symptoms of ureteral stricture for a period of 2 years, has again become pregnant and has had a recurrence of the former symptoms of ureteral obstruction. All of the patients treated during pregnancy had an associated pyelitis. It is probable that a large proportion of the pyelitis cases occurring during pregnancy and the puerperium have ureteral stricture also.

*Focal infection.* Believing that the majority of infections in the kidney and ureter were brought from distant foci via the blood stream and considering ureteral stricture as a result of the inflammation in the ureter, I examined all of the patients for foci of infection with the following results:

| PROBABLE FOCUS OF INFECTION | Cases |
|---|---|
| Tonsils | 51 |
| Teeth | 36 |
| Appendix | 2 |
| Prostate and seminal vesicles (non-specific) | 2 |

In the two instances where the appendix was thought to have been the probable focus, the patients had been operated upon for suppurative appendicitis and were both drainage cases. With them, the symptoms of ureteral stricture appeared 2 and 3 years respectively after operation. In 9 cases no focus of infection could be found. It is to be presumed that either the focus had been removed or had spontaneously disappeared before the patients were examined.

The symptoms of ureteral stricture are the general symptoms of renal urinary stasis, plus the localized symptoms in the urinary tract and in the immediately adjacent structures. Nerve trunks situated close to the ureter frequently transmit pain to distant parts. Naturally the symptoms of renal urinary stasis are much the same for all types of ureteral obstruction, which include the various forms of intra-ureteral and extra-ureteral blocking.

Just as there are varying degrees of ureteral blockage due to stricture, so there exists a wide variation in the number and intensity of symptoms. These symptoms may have an acute onset or may appear insidiously. In the majority of cases the symptoms are insidious in their onset and run a chronic or more or less continuous course. Usually there is a gradual intensification of symptoms in such cases.

Renal colic, with its accompanying symptoms, marks the beginning of a smaller number of cases. An attack of renal colic, due to

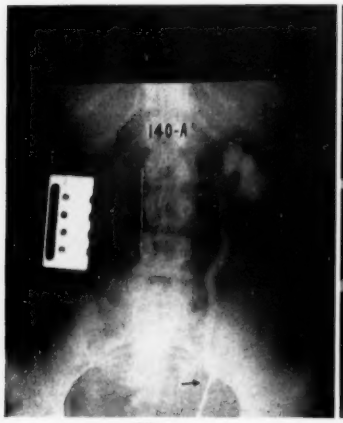


Fig. 7.

Fig. 8.

Fig. 9.

Fig. 7. Stricture, hydronephrosis. Ureter dilated above the stricture in pelvic ureter. Relieved by dilatation.

Fig. 8. Same patient as in Fig. 7. Pyeloureterogram made 7 minutes after the removal of catheter. Apparently none of the solution has escaped. According to Goldstein, a normal kidney with normal ureter should empty in 7 minutes using 13½ per cent sodium iodide solution.

Fig. 9. Hydronephrosis, hydroureter, stricture, pregnancy. Stricture in pelvic ureter demonstrated with bulb. Patient relieved by dilatation and went to term.

ureteral stricture, may be just as severe as the renal colic due to calculus blocking the ureter, or any of the other forms of ureteral obstruction. In the cases with acute onset the symptoms gradually subside and may entirely disappear for an interval. It is presumed that œdema sufficient to produce complete blockage of the ureter occurs at the stricture area during the attack.

The symptom-complex presented by sudden overdistention of the kidney pelvis and calices was described by Dietl in 1864, and "renal crises" have since borne his name. Briefly stated, Dietl's crises are characterized by sudden, severe colicky pain in the lumbar region, frequently radiating toward the groin or thigh; gastro-intestinal disturbances, nausea, gas distention, vomiting; bladder irritability, frequency, burning sensation; prostration and sometimes chills and fever. Any condition that will produce a sudden obstruction to the flow of urine from the kidney may be the cause of a Dietl's crisis. Thus, we find that this symptom-complex occurs in some cases of nephroptosis, in ureteral blockage due to calculus in the ureter, in calculus obstructing the uretero-pelvic orifice, in ureteral obstruction due to blood clot, and in many cases of ureteral stricture. Occasionally the same symptoms are produced by overdistention of the kidney with opaque solution while making a pyelogram. The mechanism of ureteral stricture in the production of a sudden and more or less complete blocking of the ureter is analogous to complete bladder retention due to urethral stricture.

Continuous partial obstruction of the ureter with resulting increase in intrarenal tension produces reflex phenomena by the same nervous mechanism as a sudden and more or less complete blocking of the ureter. Quite naturally, though, the reflex phenomena of partial obstruction are much milder than those of complete obstruction.

*Chief complaint.* The chief symptoms for which the patients sought relief are noted as follows:

| CHIEF SYMPTOMS | Cases |
|---|---|
| Pain in right side lower abdomen | 31 |
| Pain in left side lower abdomen | 16 |
| Pain in both sides lower abdomen | 10 |
| Pain in lower back | 34 |
| Gas distention | 7 |
| Frequency | 1 |
| Incontinence | 1 |

In 91 cases pain was the chief complaint. It is interesting to note that gas distention was the most annoying symptom in 7 cases.

Fig. 10.

Fig. 11.

Fig. 12.

Fig. 10. Hydronephrosis, hydroureter, stricture, pregnancy. Stricture in pelvic ureter demonstrated with bulb. Relieved by dilatation and went to term.

Fig. 11. Hydronephrosis, hydroureter, pregnancy. Stricture in pelvic ureter demonstrated with bulb. Relieved by dilatation and went to term.

Fig. 12. Completely destroyed hydronephrotic ptosed kidney, multiple strictures. Dilatation with filiforms and bougies was necessary before a catheter could be passed to kidney. An end-result of ureteral stricture. Relieved by nephrectomy after dilatation of stricture areas in other ureter.

*Pain.* In an effort to analyze pain, the following data were gleaned from a study of the case histories:

| LOCATION AND TYPE OF PAIN | Cases |
|---|---|
| Pain in lower back—chiefly right side | 31 |
| Pain in lower back—chiefly left side | 22 |
| Pain in lower back—both sides | 41 |
| Pain in lower abdomen—right side | 48 |
| Pain in lower abdomen—left side | 30 |
| Pain in lower abdomen—both sides | 16 |
| Renal colic type of pain | 48 |
| Headache | 77 |
| Dysmenorrhœa | 29 |

The pain associated with ureteral stricture has a wide range of intensity and is variable in type. Renal colic type of pain occurs in a large percentage of the cases (48 in this series). On the other hand pain may be quite mild. The character of pain is variously described by patients. Thus patients complain of, "dull, dragging pain," "aching pain," "bearing down sensation," and "sharp, shooting pain." The most common location of pain was in the lower abdomen just a little to either side of the midline. Most of the patients also had pain in the lower back. Frequently, the lower abdominal pain radiates to the same side of back and vice versa. It is to be noted from the analysis that pain occurred on the right side more often than it did on the left side.

Twenty-nine, or 46.77 per cent, of the 62 females in this series complained of dysmenorrhœa. Most of these patients had not only increased pain during the menstrual period, but an intensification of all stricture symptoms. This, as explained by Hunner, is probably due to the further obstruction of the narrowed ureter, by the œdema and congestion in the broad ligament region incident to menstruation. Headache of various types occurred in 77 patients. A considerable number of these were of the severe migraine type. It is probable that the headache is a toxic symptom which is due to retarded renal elimination and to disturbed gastro-intestinal function.

| SYMPTOMS REFERABLE TO URINARY TRACT | Cases |
|---|---|
| Frequency and nocturia | 81 |
| Burning sensation and bladder distress | 58 |
| Renal colic | 48 |
| Incontinence | 5 |
| Hæmaturia (gross blood) | 2 |
| Complete retention | 1 |

Fig. 13 (left). Pyonephrosis, multiple strictures. Stricture of intramural ureter and another opposite the sacro-iliac joint. Late case, nephrectomy required.

Fig. 14. Calculus, pyonephrosis, dilated ureter, stricture. Tight stricture involving entire intramural ureter. Marked dilatation of the ureter above the stricture. Note catheter coiled in pelvic ureter. Large, staghorn renal calculus and a number of smaller calculi in kidney. None of the opaque solution has entered the kidney. Note prostatic calculi. Nephrectomy.

It should be remembered that the urinary tract is a continuous mucous membrane lined tract, from the renal tubules to the urinary meatus. Moreover, the various parts, although anatomically divided, are closely associated through nerves, blood and lymph vessels. Therefore, pathology in one portion readily extends to the adjoining part or the effects are reflected from one part to another. Thus, the ureters are closely associated with the trigonum, and through the trigonum the ureters are brought into close association with one another.

In many cases of ureteral stricture (32 in this series) there is an associated cystitis involving particularly the trigonum. Bladder symptoms, however, also occur in the absence of inflammation and in these cases the bladder irritability is reflected from the ureter.

Incontinence occurred in five of the female cases. In two cases there was a complete loss of bladder control. Cystoscopically, both of these were found to have marked degrees of œdema in the trigonum. All of these patients regained normal bladder control following the ureteral treatments, showing that the disturbance was due to the ureteral lesion.

One female patient had a history of complete retention lasting several days in connection with each attack of severe pain due to ureteral stricture. At the time she was seen catheterization had been required for about a week. Normal bladder function was restored by relieving the ureteral obstruction.

Two patients had gross blood in the urine at the time of first examination, and the blood was seen issuing from one of the ureter orifices in each case. Each of these patients had a small hydronephrosis on the side that was bleeding. There was no other demonstrable pathology to account for hæmorrhage, and hæmorrhage ceased after ureteral dilatation. In a number of cases erythrocytes were found microscopically. Hæmaturia, due to ureteral stricture, may be explained by renal hyperdistention with consequent injury of the blood vessels coursing the renal pelvis. A parallel is to be found in cases of hæmaturia of bladder origin due to stricture of the urethra.

ASSOCIATED PATHOLOGY IN THE URINARY TRACT

| | Cases |
|---|---|
| Cystitis | 32 |
| Hydronephrosis | 15 |
| Pyelonephritis and pyonephrosis | 13 |
| Renal calculus | 5 |
| Ureteral calculus | 4 |
| Nephroptosis | 3 |

Renal and bladder inflammations are the most common concomitant lesions in the urinary tract. Ureteral stricture is the etiological obstructive factor in many cases of acquired hydronephrosis. The relationship of ureteral stricture to renal and ureteral calculi is an interesting and important subject. Stricture of the ureter can be demonstrated in a large percentage of these cases. Inasmuch as it is generally conceded that urinary stasis and dilatation of the renal pelvis favor the formation of calculi, it seems fair to believe that ureteral stricture is one of the important etiological factors of calculus formation in the upper urinary tract. To afford the patient complete relief and to avoid recurrence of the calculus, it is necessary, in addition to the removal of the calculus, to provide proper drainage of the kidney pelvis by removing ureteral obstructions.

In this series, nephroptosis, sufficiently marked to require nephropexy, occurred in three cases. The moderate and slight degrees of renal mobility are not noted.

*Urinalysis.* The urinary findings depend largely upon the pathology in the urinary tract other than stricture. In 46 cases the urine was reported as containing no abnormal elements.

SYMPTOMS REFERABLE TO GASTRO-INTESTINAL TRACT

| | Cases |
|---|---|
| Gas distention and belching | 96 |
| Constipation | 80 |
| Anorexia | 69 |
| Nausea | 59 |
| Vomiting | 39 |
| Mucous colitis | 12 |
| Diarrhœa | 5 |

The gastro-intestinal symptoms that occur in patients suffering with stasis of urine in the upper urinary tract are particularly interesting. Most of these symptoms are, of course, common to renal retention from any cause, and occur in various conditions other than urological. There is an abundance of proof to show that gas distention, belching, and vomiting are reflex phenomena. Vomiting can be produced by tickling the mucous membrance of the pharynx, or making pressure on some parenchymatous organ, such as the testicle. Ureteral stricture with its consequent increased intrarenal tension reflexly produces, in a large percentage of cases, a gastric and intestinal atony, manifested by nausea, gas distention, belching, and constipation.

Ninety-six patients in this series had some gastro-intestinal complaint. Gas distention and belching were the most common symptoms and were noted in all 96 cases. These symptoms had little or no relation to meals. Many patients stated they were distended with gas on arising in the morning. Dyspnœa, palpitation, and a feeling of pressure around the heart occurred in some patients during attacks of severe gas distention. Constipation was often of the most obstinate variety. Intermittent attacks of diarrhœa occurred in five cases. Mucous colitis, which is probably a result of intestinal atony and stasis, was noted in 12 cases. A sensation of rectal pressure is also a fairly common complaint, but an accurate record of this symptom was not noted in the histories.

That the above noted gastro-intestinal symptoms are a result of ureteral stricture in these cases, is shown by the fact that they are frequently reproduced in an exaggerated form following the first one or two treatments, and by the fact that they disappear in most cases following a course of treatment.

SYMPTOMS REFERABLE TO NERVOUS SYSTEM

| | Cases |
|---|---|
| Irritability<br>Restlessness<br>Depression<br>Neurasthenia | 33 |

The nervous symptoms in these patients are probably a result of prolonged impaired health. The more marked nervous disturbances occurred in the cases of long duration.

*Duration of symptoms.* The average duration of symptoms in this series was 3.76 years.

PHYSICAL FINDINGS

The most valuable physical sign in my experience has been tenderness elicited by pressure made with one finger over a point approximately two fingerbreadths below and to either side of the umbilicus. This I have

found to be the area of most exquisite tenderness in the large majority of cases. Dr. John E. Legge, of Baltimore, first called attention to this point of tenderness in ureteral stricture patients. Tenderness of lesser degree is found to extend downward from this point to a point opposite the pelvic brim. Of course, tenderness at the point described is found in other intra-abdominal lesions, but tenderness at this point is found in such a large percentage of ureteral stricture patients that the finding is highly suggestive of the lesion under discussion. It is likely that the point to either side and below the umbilicus is the skin area supplied by the same spinal cord segment that innervates the kidney and upper ureter.

In females the tender infiltrated ureter can often be palpated vaginally, or tenderness can be elicited by slight pressure in the ureteral region. The ureteral tenderness is medianward from ovarian tenderness.

In a large number of the patients, it was impossible to elicit definite renal tenderness by the usual bimanual method of kidney palpation. Definite tenderness over one or both kidneys was noted in 39 of the records.

ABDOMINAL PHYSICAL FINDINGS

| | Cases |
|---|---|
| Ureteral tenderness—bilateral | 54 |
| Ureteral tenderness—right | 27 |
| Ureteral tenderness—left | 17 |
| Kidney tenderness—bilateral | 10 |
| Kidney tenderness—right | 20 |
| Kidney tenderness—left | 9 |

From the history and physical examination, the diagnosis of ureteral stricture can be made with a fair degree of certainty in most of the cases. If one will keep in mind the mechanism by which ureteral stricture produces symptoms, there should be little difficulty in recognizing its manifestations. The ultimate diagnosis must, of course, be made by cystoscopic methods. There is no single cystoscopic method of diagnosis applicable to the detection of stricture in all cases. When possible, the passage of a ureteral instrument with a bulb, and the feeling of a firm hang in the ureter during removal gives the most reliable evidence of stricture. It is impossible in many cases to pass a bulb through the ureter orifice, and in others it is impossible to manipulate a bulb through the stricture area at the time of the first examination. In fact, only the smallest bougie or whale bone filiform can be passed at first in some cases.

Pyelo-ureterograms give dependable information regarding stricture in many cases, but the radiographic evidence can not be absolutely depended upon. Stricture areas may not be demonstrated on account of incomplete filling of the ureter, and on the other hand not all filling defects in the ureter are due to stricture. Finally, in a few cases one must depend for the diagnosis on the results of treatment.

SIDE INVOLVED

| | Cases |
|---|---|
| Bilateral | 63 |
| Right | 22 |
| Left | 15 |

Hunner has found that most patients suffering with ureteral stricture have areas of infiltration in both ureters. In this series stricture areas were demonstrated in both ureters in 63 instances. The right ureter only was involved oftener than the left.

PREVIOUS LAPAROTOMIES

Forty-two patients had a total of 59 laparotomies. Two patients each had 4 laparotomies.

It is well to appreciate the fact that ureteral stricture patients are frequently people of many ailments. Often as a result of focal infection, they have had a number of inflammatory processes in various organs and tissues. One would, therefore, expect to find that a number of these patients have required laparotomy. Thus some of the patients in this group apparently did not have symptoms suggestive of ureteral stricture preceding the operation and stated that they were relieved by operation. On the other hand, if credence is to be given to patients' statements regarding the results of previous operations, there were a relatively large number that were unimproved following laparotomy.

TREATMENT

The treatment consists of gradual dilatation of the stricture areas, appropriate treatment of the associated pathology in the uri-

nary tract, and lastly but equally as important, the removal of all discernible foci of infection. In this communication the various methods of ureteral dilatation will not be discussed. It may be stated, however, that large bulbs on catheters and bougies can be passed with almost equal facility in the male and female through the McCarthy panendoscope.

## RESULTS

The relief obtained by many patients is frequently spectacular and prompt. Nearly all of the patients are relieved or improved by treatment based on the diagnosis of ureteral stricture. In this series it has been possible to check the results of treatment in 67 cases. Questionnaires or direct information from these patients 12 months after the last patient in the series was treated yield the following information:

| | Number of cases |
|---|---|
| Completely relieved | 18 |
| Markedly improved | 35 |
| Improved | 11 |
| Unimproved | 3 |

A few pyelo-ureterograms depicting some of the radiographic findings in these patients are shown in Figures 1 to 14.

## REFERENCES

1. Hunner, Guy L. Article in Cabot's Modern Urology, 1924. J. Urol., 1924, xii, 295; 1925, xiii, 497; 1926, xv, 57.
2. Rathbun, Nathaniel P. J. Urol., 1925, xiv, 403.
3. Goldstein, Albert E. J. Urol., 1921, vi, 125.

## DISCUSSION

Dr. Guy L. Hunner, Baltimore: One of the most interesting features of Dr. Tolson's paper is the fact that a man can begin the study of a disease with which the profession of his community is not familiar and can report having diagnosed, studied, and treated 100 cases of that disease within a period of 18 months. This means either that the disease is an exceedingly common one or that the man making the report is what some of my friends have feared for me, to put it mildly and politely, "an enthusiast."

Is it not strange, however, that history keeps on repeating itself, and that each new man who takes up the study of this problem in a thorough and intelligent manner makes just such a report as has been so ably presented this morning by Dr. Tolson.

It is interesting that the prominent urologists over the country to whom we should be able to look for our advanced ideas in urology, are still largely satisfied with swivel chair arguments against this conception rather than go to the trouble of making an intelligent investigation. They do not seem to realize that there are scores of lesser lights scattered over the country who, like Dr. Tolson, have investigated the problem and are now giving relief to many conditions of renal pathology by methods far simpler and more effective than we have employed in the past.

Dr. Tolson has been fortunate in having the early co-operation of the surgeons of this community who have been very glad to have him throw light on some of their perplexing problems. I understand that the surgeons of Cumberland now refuse to operate again until the urinary tract has been thoroughly investigated on the patient who presents herself with a half dozen abdominal scars, representing the removal of the appendix, then a tube and ovary, then the gall bladder, and who has then had one or more operations for adhesions that are supposedly causing the trouble, although the patient's symptoms are about as they were before any operation was done.

He is also fortunate in having had the co-operation during this work of a careful and progressive medical man, Dr. John Legge, who is now practicing in Baltimore. I have the information directly from Dr. Legge, that in many gastro-intestinal conditions in which no definite causative pathology can be found and in which all ordinary therapeutic measures fail, he has had the greatest satisfaction in turning many of these patients over to Dr. Tolson to get well by having good kidney drainage established.

In the light of our traditional knowledge and practice, it seems highly ridiculous to make such claims as those presented by Dr. Tolson concerning the interrelationship of so many gastro-intestinal symptoms with the urinary tract. I noticed that he had 12 cases in which the therapeutic results seemed to indicate that a mucous colitis could be dependent on ureteral stricture. In a paper published two years ago on the end-results in 100 cases, with a time interval of 5 or more years since ceasing treatment, I reported 15 cases of chronic mucous colitis; in 12 of which, 80 per cent, we had obtained good results through establishing better kidney drainage.

I was much interested to see that Dr. Tolson has found stricture in men and women. I said from the start that if my theory of focal infections being the cause of most ureteral stricture is correct, we should find stricture in about as many men as women. Dr. Goldstein, who came to my support early in this work, was the first to publish the fact that stricture is frequently found in men, and his work in the dead house and in the clinic seems to indicate that gonorrhœa is not an important factor in causing ureteral stricture in men.

There are many other features of this carefully prepared paper that I should like to discuss but our time is limited and I am sure we would all like to hear from Dr. Goldstein about the results he and Dr. Carson have had in looking for stricture in the autopsy room.

DR. W. CALHOUN STIRLING, Washington, D. C.: I enjoyed Dr. Tolson's interesting paper on ureteral stricture and also Dr. Hunner's discussion. Dr. Hunner is one of the pioneers in this field and deserves much credit for his thorough work in spite of the adverse criticism he received at first from urologists. Many urologists have become converted to the idea that ureteral stricture is common; and as Braasch says: "If Hunner is right in only one-fourth of his findings the subject deserves serious consideration." Many cases have been reported by Rathburn, Livermore, and Lowsley in the male, as Hunner's work was confined to the female. Our therapeutic knowledge of ureteral disease has advanced beyond the diagnostic side, as in many renal infections, the simple insertion of a ureteral catheter to the kidney has sufficed to clear up these urinary infections regardless of the cause. Whether the primary etiology is the result of soft periureteral infiltration as Smith suggested, or whether the obstruction is intra-ureteral as believed by Hunner, has been the bone of contention. Much dispute has centered about the wax-bulb as a method of diagnosis. Many urologists contend that spasm and other extraneous conditions will give the hang on withdrawal. By a combination of ureteropyelogram and wax-bulb any definite constriction in the ureter may be accurately localized. If there is enough obstruction to cause infection, the ureter should be dilated above the point of infiltration as shown by a ureterogram. I have seen quite a number of ureteral strictures evidenced by a pyelo-ureterogram, and feel that all cases of pyelonephritis should have the ureter well dilated before the patient is discharged.

Dr. Hunner tells me that he does not enjoy these meetings as much as he did in the past as everyone has stopped fighting his work and enthusiastically joined in the hunt for ureteral stricture.

DR. A. E. GOLDSTEIN: One listening carefully to Dr. Tolson's paper, also examining his tables, would imagine that an individual having a ureteral stricture could have almost any symptom in the category of medicine. While I do not think it is quite that extreme, nevertheless, the unfortunate patient suffering with a ureteral stricture does and can have a variety of symptoms. Unquestionably, the author has found a large number of strictures, more in proportion to the number of patients examined than I have encountered. In presenting papers of this kind before a scrutinizing group of medical men one must be very careful in the presentation of his statements. His method of procedure in diagnosing a condition that is not so readily accepted by all should be carefully gone over and use made of all available methods to make accurate diagnosis. While I am a believer in ureteral strictures, I have resorted to various methods. One or two of these have followed more recent investigations while others have been published before.

In cases in which a suspicion is aroused as to the possibility of the presence of ureteral stricture several procedures are carried out. I would like to call the author's attention to some of these. When I first became interested in Dr. Hunner's work 7 or 8 years ago, I immediately recognized the fact that the medical profession was not willing to accept the "hang" method of Dr. Hunner's as a diagnostic point in determining a ureteral stricture. It was felt that more evidence was necessary, evidence of a visual type. Being of the belief that where there is an obstruction in any lumen, there should, after a sufficient length of time, follow a dilatation behind the obstruction, I proceeded to ureteropyelograph all individuals suspected of ureteral stricture. Inasmuch as this method definitely demonstrated a dilatation, no case of mine was called a ureteral stricture unless the ureteropyelogram demonstrated the dilatation behind it. True enough, in the largest percentage of cases a "hang" was obtained in the cases in which a dilatation was found, if a large enough bulb was used. In a number of cases a "hang" was obtained but no dilatation was found. These cases were ruled out, although since then I feel that in some cases one may have a stricture without a dilatation.

Following this work, experimental work was done in determining the length of time it took the normal human ureter and renal pelvis to empty itself of a 13.5 per cent solution of sodium iodide. It was found that this took place in from 4 to 8 minutes. With this knowledge at hand, further experimental work was carried out and pathological cases were taken. It was discovered that wherever a pathological ureter or renal pelvis was being dealt with, there was a delay in the time at which the solution left the pelvis and ureter. We have had cases in which the solution remained as long as 4 hours. Definite ureteral stricture cases always showed a stasis and final conclusions were made in suspicious cases, all depending upon the emptying time of the renal pelvis and ureter, if no other pathology was found. We have felt that if there is a stasis of sodium iodide solution, there is in all probability a stasis of urine.

In carrying out some of the above procedures, one is able to check up their findings and in conclusion visualize a ureteral stricture by radiographic impressions of stasis.

Dr. Tolson should be congratulated for his very interesting and painstaking piece of work and I trust that he will make use of all possible available methods for diagnosis.

# UNDESCENDED TESTICLE

## With Special Reference to Torek's Method of Orchiopexy[1]

By HERBERT WILLY MEYER, A.B., M.D., F.A.C.S., New York
Associate Attending Surgeon, Lenox Hill Hospital; Assistant Attending Surgeon, New York Skin and Cancer Hospital

UNDESCENDED testicle is a condition with which the surgeon is frequently confronted, and it is important that he apply proper treatment.

It is usually the family physician who first diagnoses the condition. A swelling is noticed in the groin which may be associated with pain and a dragging-down sensation. A physician is consulted, and examination reveals the presence of a hernia and an empty scrotal sac. The testicle may or may not be palpable in the inguinal region. Such findings may be unilateral or bilateral. As a potential hernia is almost always associated with an undescended testicle, i.e., the tunica vaginalis communicates with the general peritoneal cavity, attention is directed more toward the cure of the hernia than to the location of the testicle.

It is sometimes the medical confrère, who sees the case first, and he is opposed to surgical interference. He claims that the undescended testicle usually does not enlarge, develop, or functionate better when it has been brought down, than when it is left where nature has placed it. Further, that the surgical risk is not warranted on account of the usual poor late surgical result.

In answer to this viewpoint we wish to state that the surgical risk is more than warranted, if we can cure the hernia and can bring the testicle down into the bottom of the scrotum and keep it there without atrophy. This procedure makes a normal looking individual out of a boy or man. This is especially so in cases of bilateral undescended testicles.

Can we surgeons offer our patients and our medical confrères an operation that will cure the hernia, that will give a good cosmetic result that will do no harm, that will cause no atrophy of the testicle, no retraction against the pubic bone or into the inguinal canal, and that will give a minimum of poor late results? We can! And it is for this reason that we wish to impress upon the laity, the family physicians, and surgeons the facts, first, that these patients should be treated surgically; second, that undescended testicles should always be saved; and third, that of all the various types of operations devised for this condition, the operation of choice has proved to be the method of Torek's orchiopexy.[2]

Before we take up in detail the technique as proposed by Dr. Torek and practiced in a series of cases at the Lenox Hill Hospital by Drs. Torek, Eggers, Pickhardt, and myself, we will look a little more closely into the etiology and pathogenesis of undescended testicles.

### ETIOLOGY

The chapter on the etiology of undescended testicle has by no means been closed. Many interesting theories have been advanced. The condition is considered almost always as due to an incomplete development of the various organs, which, directly or indirectly, act as a basis for this anomaly. The gubernaculum testis is considered by some as the cause of the trouble, and years ago Tillmanns showed that in these patients muscular fibers were missing in the gubernaculum. While Lockwood, Godard, Sebileau, and others consider the gubernaculum as an etiological factor, Championnière and Coley oppose this view.

The obstruction that the inguinal canal may offer to the descent of the testis must be of great importance. This may be either a narrowing of the entire canal or a stenosis of the external abdominal ring. A normal testis could be prevented from leaving the inguinal canal by the stenosis of the external ring. On the other hand some patients present an external ring so large that upon any stimulation of the cremasteric reflex the normally placed testicle may be drawn up into the

[2] While in the literature one finds the term "orchidopexy" used almost exclusively, the best authorities would seem to prefer the spelling "orchiopexy." The word is derived from the Greek word "orchis," the genitive of which is "orchios." Therefore, in this article we shall spell the word "orchiopexy."

From the Surgical Service of Dr. Carl Eggers at the Lenox Hill Hospital, New York. Read before the surgical section of the New York Academy of Medicine, January 8, 1926.

inguinal canal. Luxations of the testicle into the inguinal canal, perineum, and even into the abdominal cavity have occurred as the result of sudden muscular force, as in riding, jumping, or swimming. Hofstaetter has described a group of 8–10 year old boys whom he had examined, who could luxate their testes and push them into the inguinal canal and even into the abdominal cavity. On one occasion one of these boys could not replace a testicle which he had pushed up above the penis and only with difficulty could it be replaced by the doctor.

Some authors believe that adhesions between testicle or epididymis, or spermatic cord, or tunica vaginalis with the peritoneum may be the cause of the non-descent. These bands might be the result of fetal peritonitis, although all authors mention the impossibility of proving whether the inflammatory process was an antenatal or postnatal affair.

The length of the spermatic cord is of course also of great importance. The cord is composed of the spermatic artery, coming from the abdominal aorta, and the plexus of spermatic veins, which enter the interior vena cava on the right side and the left renal vein on the left side. Besides this is the vas deferens with its accompanying artery, a branch of the superior vesicle of the internal iliac artery, and in almost all cases the tunica vaginalis communicating with the peritoneal cavity, the congenital hernial sac. These structures are covered by the cremasteric fibers. The latter are surely not the cause, and the vas is practically always long enough. However, the spermatic vessels and the peritoneal pouch are frequently too short, and do not allow the testicle to come down to its normal position.

Cryptorchidism may be heriditary, and authors such as Finotti, Buedinger, Klein, Le Denter, Gosselin, Vidal, Szymanowski, Ziebert, Kocher, Godard, Marchand, Lanz, Pichon, Hetz, Katzenstein, and Hofstaetter have described cases in detail in which the condition was seen to occur in several generations of certain families.

That the size and structure of the scrotum also plays a part, must also be evident. Some of the poor late surgical results must be due to the small rudimentary scrotal sac, which, though stretched and easily receiving the testicle at the time of operation, quickly contracts to its original rudimentary size soon after the operation by the contraction of the dartos muscle, which has been found to be well developed, even in the rudimentary scrotal sacs. This of course draws the testicle up against the pubic bone where it lies exposed to frequent trauma.

One of the most promising theories has been advanced by Turner in conjunction with the work of Homanns and Bunges, who feel that the abnormal position of the fetus *in utero*, with abnormal pressure of the thigh against the inguinal canal, may prevent the normal descent of the testicle through the inguinal canal into the scrotum. Hofstaetter confirmed the findings of Turner. In the same line of thought we must consider the possibility of a peri-orchitis fixing the testis in the inguinal canal, when during birth, an undescended testis is injured, and a hæmorrhage occurs into the testis or into the scrotum, as is sometimes seen in breech presentations. This is similar to the caput succedaneum or the cephalhæmatoma.

The fact is also of interest that some men have artificially induced ectopic testes, in order to be exempt from military service. M. A. Galin published the report of 3 cases in which the patients bore a star-like scar over the inguinal canal which had been produced either by the wearing of a truss or by an injection to cause an inflammatory reaction and thus fix a testicle which formerly had been normally lying in the scrotum in the inguinal canal. Von Cackovic published a case of a man, the father of two normal children, who was so annoyed by a long scrotum with the testes in it, that he pushed the testes into the inguinal canal and by wearing a truss caused bilateral inguinal testes.

Lately Sonneland has formulated a theory of his own based on experimental work. The train of thought is logical and interesting. He reverts to the theory that the gubernaculum testis is the prime factor in guiding the testis; namely, that the genital gland has its analage from the sixth thoracic to the second sacral segment. Of these segments

10 to 11 degenerate from above downward, so that the origin of the genital gland extends only over 3 to 4 segments. Thus there is no internal descent.

The chorda gubernaculi, conical in shape, with the apex at the inguinal fold, and the base at the integument, is surrounded of necessity by the abdominal musculature, when this begins to differentiate and grow. In this manner the inguinal canal is formed.

A continuous cord forms by the union of the ligamentum testis and the chorda gubernaculi, which then extends from the lower pole of the testis, passes through the inguinal canal and terminates in the integument at the base of the genital tubercle, which later forms the depths of the scrotal sac. The chorda gubernaculi, then, is made up of fibrous and smooth muscle tissue and marks the path along which the testicle should descend.

Since the lower pole of the testis is connected with the anterior abdominal wall by the chorda gubernaculi, one can understand that, as the anterior abdominal wall of necessity separates from the posterior abdominal wall, in order to make room for the intestines, the testis becomes separated from the posterior abdominal wall.

The vertical position of the long axis of the testis becomes horizontal during this procedure as the chorda gubernaculi becomes taut, and the testis is thus directed toward the internal abdominal ring. In the seventh month of fetal life the testis descends through the inguinal canal and at the eighth month, or just before birth, it reaches its final position in the scrotum.

Abdominal retention of the testis might be explained by the pressure of the stomach and intestines exerting such force that the gland does not make its normal connections. The ligamentum testis and the chorda gubernaculi, running from the inguinal fold to the inguinal crest, do not come together and fuse, and the testicle is not directed toward the inguinal canal. It is also possible that there may be an anatomical or physiological deficiency in an actually formed chorda; for instance, a tear in the chorda gubernaculi, due to a local weak point, or it may be that the chorda is too long and sags and thus fails to direct the testicle toward the inguinal canal.

Once the testis enters the inguinal canal, new forces come into play in order to cause its descent. These are intra-abdominal pressure, intermuscular pressure, and the active contraction of the smooth muscle constituents of the chorda. When the testicle is outside of the external abdominal ring, again new forces enter into play—the testis is now interfascial and not intermuscular. The passage from the inguinal canal over the crest of the pubis into the scrotum is fraught with dangers and difficulties, as the course of the testis is directed solely by the smooth musculature of the gubernaculum. If the action of these fibers is insufficient, then pubic arrest occurs; and if the fibers tear through, the testis is loose, and its movement is controlled only by the length of the spermatic vessels. Sonneland contradicts Lockwood's theory of multiple gubernaculi to explain the perineal, interstitial, penile, and femoral positions of the ectopic testis. Sonneland explains this on the basis of a functionless gubernaculum, a sufficiently long spermatic cord to permit excursion of the testis on well defined fascial planes outside of the external ring, and upon the peculiarity and constancy of these fascial planes over the lower part of the abdominal wall and perineum, and, finally, upon the operation of physical laws that govern moving bodies.

It was found that outside the external abdominal ring the chorda gubernaculi functioned alone and was solely responsible for the movement of the testis. The occurrence of a tranverse separation of the fibrous and muscular components of the chorda, due to undue stress upon it, explain the essential factors of ectopic testicle.

Once the gubernaculum is torn the testicle is free to move. If the cremaster is well formed and the spermatic vessels are taut, as the gubernaculum tears, the testicle will slip back into the inguinal canal; but, if the cremaster is lax and the spermatic vessels are long enough, the testis may luxate into any of the fascial pockets it may find open and easily accessible, and into which the factors of

gravity may tend to direct it. Thus the well-known positions of ectopic testicle are perineal, interstitial (i.e. between Scarpa's fascia and the aponeurosis of the external oblique muscle and close to the external abdominal ring), and the penile ectopic testicle. When an ectopic testicle is femoral, this occurs by the sagging of the testicle retroperitoneally to the femoral ring, and the luxation of the testis through this into the femoral canal.

The question, however, whether the undescended testicle is in itself mal-developed from the very beginning of fetal existence, and thus is the cause of poor descent, or whether the testis is primarily entirely normal and on account of the non-descent becomes secondarily atrophied with histological changes, is as yet an unsettled problem. The weight of the evidence seems to be on the side that the undescended testis is primarily not an entirely normal testis.

### PATHOLOGICAL ANATOMY AND HISTOLOGY

Undescended testes are mostly smaller and softer in consistency than normal, while the epididymis is usually well developed. Some cases have been observed, however, and reported, in which the testicle was normal while the epididymis and vas were absent, and vice versa. But usually the vas deferens is of ample length, and in arrested testes sometimes loops down out of the external ring into the scrotum, while the spermatic vessels are of insufficient length and are bound down by fascial strands and adhęsions. The processus vaginalis communicates with the peritoneal cavity, and thus a complete or incomplete congenital hernia is almost constantly present. The scrotum varies in size, but while it can be stretched, it seems in some cases to be very rudimentary and almost absent. This is especially true when the condition is bilateral and the patient beyond the age of puberty.

If, however, the condition is unilateral, the one side of the scrotum may be normally developed while the abnormal side is rudimentary and atrophic. Though the scrotum may be stretched manually, it often quickly assumes its original shape and position up against the pubic bone.

Ordione and Simmons and especially Uffreduzzi have studied the histology of undescended testicles carefully and have found the thickening of the tunica albuginea and of the basement membrane of the tubules almost constant. This thickening may be so marked as to occlude the lumen of the tubules. The lining epithelial cells of the tubules, or the spermatogenic cells, are abnormal, few in number, and irregular in shape and rarely show normal spermatozoa. The interstitial cells which furnish the internal secretion of the testicles are well developed and are present in large numbers. At the time of puberty there may be spermatogenesis for a short time, but this usually disappears after a few years as the more highly specialized cells degenerate and are destroyed. Then sterility sets in. Replacement fibrosis takes the place of these higher type of cells. Uffreduzzi states that spermatogenic cells are present in about 10 per cent of all cases of undescended testicle. The authors who agree with Uffreduzzi and state that they believe that most of the undescended testes functionate and produce spermatozoa are: Curling, Hunter, Schaedel, Astley Cooper, Lauenstein, Monod, Szymanowski, Debron, Beigal (normal spermatozoa in a case of bilateral undescended testicles), Besancon, Arthaud, Marshall, Taylor, Pelikan, Liegens, Hoffmann, Finotti, Wilson, and R. Wolf. Opposed in their views are especially Follin, Godard, Peuch, Gouteaux, Partridge, Massie, Basson, Lanz, Corner, Eccles, Minervi, Rolando, and Bardeleben.

Ziebert has written a splendid summary of the thought on this subject. Basso examined six undescended testicles in adults and found microscopically normal spermatozoa in one case, normal spermatogenic cells in another and in the other four cases the spermatogenic cells were missing but the interstitial cells and cells of Sertoli were abundantly present and normal.

This brings us to the vital subject of the internal secretion of the testicle. This internal secretion, which causes the development of the secondary sexual characteristics, comes from the interstitial cells. They are almost never absent, even in a small undescended

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## SECONDARY COMPLICATIONS OF UNDESCENDED TESTES

It is not alone the absence of the testicle in the scrotum that brings the patient to the physician, but it is the presence of one of the secondary complications that bring with them symptoms which send the patient to the doctor for advice.

*Malignant degeneration.* There is a tendency toward neoplastic degeneration in undescended testicles. This has been overestimated, however. Kocher reported on 55 collected cases without a cure. Szymanowski, himself, died of metastases following an operation by Pirogoff for malignant degeneration of a left inguinal testicle. Ordione and Simmons state that 11 per cent of all malignant testes occur in undescended ones, while Coley puts the figure at 8.8 per cent. Von Kahlden pointed out that abdominal testicles are not as apt to be malignant as inguinal ones which are exposed to trauma. J. Wolff states that malignancy never developed in a transplanted testicle; that is, one that was brought down by operation. The fear of malignancy certainly never should be a cause for castration. McAdam Eccles did not find a single case of undescended testicle with malignant degeneration in 854 cases of undescended testicle examined by him for the London Trust Company. We also have not seen a case of

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Fig. 5.

Fig. 6.

Fig. 4. Cord structures dissected showing hernial sac emerging between spermatic vessels passing upward and vas deferens passing downward at internal abdominal ring.

Fig. 5. Stripping the spermatic vessels from the peritoneum with the finger well up within the internal abdominal ring, and bluntly dividing fascial strands and adhesions of the vessels to surrounding structures. A hernia hook in the internal ring is retracted upward.

Fig. 6. Hernial sac ligated and resected. Spermatic vessels have been lengthened by freeing of fascial strands and adhesions, allowing testicle to be brought down to a proper level on the thigh, where the testicle comes to lie without tension.

malignancy in our series of undescended testicle at the Lenox Hill Hospital.

*Chronic inflammation.* Undescended testicles are more susceptible to tuberculosis and gonorrhœal infection than normally placed testicles. Luetic involvement is rare. Delbet warned against suturing one testicle to the other on account of the possible infection of the normal testicle by the one which was brought down, and which is more susceptible to infection.

From chronic injuries to an undescended testicle a chronic orchitis must set in with induration, shrinking, atrophy, and adhesion of the testicle to the surrounding structures. Curling, Championnière and Rizzoli have described cases that died from a generalized peritonitis, secondary to an orchitis with periorchitis. This may be caused by the wearing of a truss to overcome the accompanying hernia.

*Strangulation of abnormally placed testicle.* Following undue force or sudden strain an inguinal undescended testicle may be forced out of a very tight external abdominal ring and become strangulated, on account of the impossibility of the testicle to return into the inguinal canal. This condition is accompanied by all signs similar to an incarcerated hernia.

*Relation to hernia.* While a congenital hernia is present in almost every case of undescended testicle, this is not true in 100 per cent of all cases. Lotheissen and Keetley found hernias present in only 40 per cent, while the following authors believe that hernial sacs must be found with every undescended testicle: Richter, Cooper, Dupruytren, Pelletam, Linhart, Ploss, Ziebert, Minervi and Rolando, Curling, Tillmanns and Schoenholzer, Bevan, Coley, Championnière, Basso, Morestin, Dorofejew, Lonligoux, and Lanz. Some of these authors described cases in which the inguinal testicle caused an incarceration of the hernial sac contents.

*Ectopic testicle and hydrocæle.* This can occur as the result of pressure, as Szymanowski described, when a hydrocœle developed around his own undescended testicle, due to the pressure of a tight pair of trousers against the testicle during a long carriage drive. This type of hydrocœle must of course be differentiated from a true hydrocœle in a closed tunica vaginalis.

*Torsion of spermatic cord and testicle.* The first description of this condition was made by Delasiauve in 1840. Then followed Follin in 1852, Scarenzio in 1859, Laught in 1871, Chauveau in 1875. Nicoladoni studied the

Fig. 7.

Fig. 8.

Fig. 7. An oblique incision is made in the thigh exposing the fascia lata, and a similar oblique incision is made in the scrotum. The insert shows the method of placing the posterior interrupted sutures of chromic catgut.

Fig. 8. Posterior suture line completed.

condition in detail in 1885 when he diagnosed and recognized the condition in one of his patients. Lotheissen also studied the phenomenon. Corner and Ziebert speak about the frequency of torsion of the cord that is not recognized. Mohl mentions that it occurs quite frequently also in normally placed testes. Howard observed 6 cases in undescended testicles and 8 in normally placed testicles. Uffreduzzi collected 80 cases of strangulation and gangrene of the testicle due to torsion of the cord and found that 60 per cent occurred in undescended testicles. As a whole, trauma is the etiological factor in torsion. Most of the torsion cases reduce themselves. Uffreduzzi described a case that occurred in a boy of 11 while asleep. The result is at first venous stenosis, then venous blocking, then arterial anæmia, followed by gangrene. Treatment depends on the condition of the testicle. If it recovers its circulation easily, mere drainage will save many of these testicles.

*Ectopic perineal testicle.* Hunter gave a classical description of this condition in 1786.

*Ectopic transverse testicle.* This condition, in which the ectopic testicle is found in the opposite scrotal sac, with the normal testicle, was described first by v. Lenhossek in 1886. Other cases were described by Halstead, Romanowsky, Winiwarter, and de Castelli.

*Double testicles.* In over 300 years there are only 7 to 8 cases reported in which it was proved that there were no testicles at all, and only 23 cases in which there was only 1 testicle. Due to the division in the anlage of the testicle there may be two small testes in place of a single one. There are very many reports of this condition in the literature with all sorts of varieties described.

*Abdominal testicles.* These abdominal testicles may lie on the pelvic muscles, or just inside of the internal abdominal ring, or they may have slipped down into the pelvis and assume the normal position of the ovaries in the female. The therapy may depend somewhat upon the opinion of the surgeon as to the possibility of malignant degeneration. In a large series of cases, Howard found malignancy in 8 inguinal testicles and none in abdominal testicles. Eccles sees no reason why the abdominal testicles should have a predisposition for malignancy. While there are often no hernias accompanying abdominal testicles, Hofstaetter found 6 hernias in 15 cases of abdominal testicles. Koenig, Bezancon, Coley, Villard, Russel Howard, Wolf, Anschutz, Lauenstein, Schoenholzer, Lanz, Zwanziger, and Eccles among others are opposed to operative interference and favor leaving the abdominal testicle alone. Per-

Fig. 9.

Fig. 10.

Fig. 11.

Fig. 9. Haemostat passed upward into inguinal wound to grasp testicle and bring it down into thigh-scrotal wound.

Fig. 10. Testicle sutured to the fascia lata of the thigh with 2 or 3 interrupted chromic sutures.

Fig. 11. Anterior thigh scrotal wound closed with interrupted silk sutures thereby completely burying the testicle

sonally we do not see why an attempt should not be made at orchiopexy, in almost all cases, if only for cosmetic and psychological reasons, and in the majority of cases the testicles can be brought down, especially those just within the internal abdominal ring. On the other hand there can be no harm in leaving the testicles alone.

### SYMPTOMS

The most frequent symptom found in undescended testicle is pain, which at times may be very severe. Cases have been observed in which chorea, eclampsia infantum and hystero-epileptic attacks have ceased, following operation for undescended testicle. Coley and Ziebert have described such occurrences. Dizziness, cramps, and vomiting have been observed which could be attributed to the undescended testes. Of course, all symptoms accompanying hernia may be present, due to the usual concomitant hernia. In children there are no mental depressions and psychic disturbances, which, however, may occur in boys and men when they begin to realize their abnormality and its relation to their belief of their sexual powers. These symptoms may be quite marked. They are depressed at the thought of being abnormal and the fear of not having normal sexual powers with possible sterility. A student of Astley Cooper committed suicide, after hearing a lecture on undescended testicles. He went home in a state of mental depression due to the fact that he had bilateral undescended testicles, and feared sterility. An autopsy was performed and two perfectly normal abdominal testicles were found with normal spermatogenic cells and spermatozoa. Uffreduzzi has shown that undescended testicles occur frequently in individuals who also show other constitutional abnormalities, who are defective mentally as well as bodily.

The type of patients who come under our care for undescended testicles, however, are usually perfectly normal boys and men, athletic, active, mentally keen and bright, and sexually normal, though possibly sterile. It is the pain, and swelling, due to the hernia, that brings them to the doctor.

### INCIDENCE

Hofstaetter examined 600 male newborn children. In 450 of these, born at term, he found normal testicles in 96 per cent. In 150, prematurely born children, the testicles were normally placed in only 68 per cent. The extra-uterine existence of the latter hastened the descent of the testicle, and in 8 to 10 days after birth, almost all testicles were either in the scrotum or slipped out of the external abdominal ring easily.

Marshall found undescended testicles in 1.02 per cent out of 108,000 men examined.

Fig. 12.

Fig. 12. Hernia repaired by placing of Bassini sutures and burying the cord structures so that they emerge at the pubis.

Fig. 13.

Fig. 13. Closure of inguinal canal by suture of external oblique aponeurosis.

Fig. 14.

Fig. 14. Operation completed. Strip of gauze placed as dressing in canal behind the scrotum.

Ziebert, from 1870 to 1882, reports 14,057 cases out of 6,962,543 men examined for the army in Austria.

McAdam Eccles found 2 per cent of undescended testicles in 48,000 hernia cases.

Bevan puts the occurrence at 1 in 500.

Coley reports 3 per cent in 14,410 children under 14; 2.2 per cent in 3,848 between 14 and 21 years; and 0.2 per cent out of 37,370 over 21 years.

P. Berger reports 116 cases; one-half were on the right side, one-fourth on the left side and the other one-fourth were bilateral.

Hofstaetter reports 181 cases; 99 were on the right side, 54 on the left, and 28 were bilateral.

A possible explanation for the greater frequency on the right side may be that the left testicle descends more readily due to the greater pressure of the sigmoid, which fills more easily than the cæcum.

During the examinations of the drafted men in the World War, the United States War Department showed in their statistics that of all the men examined 8,538 cases of undescended testicle were recorded, 3.1 per cent.

### INDICATIONS FOR OPERATION

Operation is indicated (1) when the patient is suffering pain; (2) when he presents superficial vulnerable testicles lying under the skin, sometimes against the pubic bone; (3) when the danger of torsion of the spermatic cord with ensuing gangrene of the testicle is feared; (4) when we wish to overcome the greater susceptibility of the undescended testicle to gonorrhœal infection and other chronic inflammations; (5) when sensitiveness and psychic depression are caused by the condition; (6) when we wish to eliminate the tendency toward the development of malignant tumors in a testicle exposed to constant trauma; (7) when it is necessary to cure a hernia with its possible complications; (8) when it is desirable to increase the possibility of stimulating spermatogenic power. In some patients it is possible that most of the spermatogenic cells are destroyed early by trauma and other outside influences on a testicle which lies in the inguinal canal. When such a testicle is brought down by orchiopexy some spermatogenic cells may still be present which may deliver normal spermatozoa which will live on in the more protected position of the testis even though the majority of the spermatogenic cells cease to functionate.

### TIME OF DESCENT AND TIME FOR OPERATION

Testicles usually descend into the scrotum before birth, but many complete the descent during the first year of life. Hyrtl and Mayor

Fig. 15.

Fig. 16.

Fig. 15. Left undescended testicle with inguinal hernia. Age 25. Note atrophic left scrotal sac. (Author's case.)

Fig. 16. Two weeks after the first stage of orchiopexy. Hernia repaired and testicle sutured to fascia lata of thigh and scrotum sutured to skin of thigh.

pointed out that the testicles may descend much later. Mayor reported a case in which the testicle came down when the patient was 35, but it brought a hernia down with it, which caused symptoms. Schoenholzer states that especially in bilateral cases there is a tendency for one testicle to descend later spontaneously. Buehlman attributes the frequent descent of the testicle during the first year of life to the straight direction of the inguinal canal in newborn children, a condition which he found at post mortem examinations. Only when the pelvis has increased in size at the end of the first year, does the inguinal canal become oblique and afford an obstruction to the descent of a testicle which has failed to come down.

Hofstaetter believes that when descent occurs later in life it is usually caused by the enlargement of a hernia, which has pushed the testicle down; he does not believe that in its descent the testicle drags the hernia with it, because in almost all cases of late descent a larger hernia is present as a complication. This then brings up the problem as to the best age at which to perform the operation.

Some authors state that operation should be done a few years before puberty, others at the time of puberty, and still others that the operation should be done when the patient is very young. It is our belief that in unilateral cases with one normal testicle it is best to operate when the patient is between the ages of 8 and 10. In bilateral cases, however, the operation should be done earlier, or just as soon as asepsis can be maintained by the cessation of uncontrolled micturition.

With the splendid results which follow the use of the methods of procedure at our disposal we believe that with no interference in the blood supply of the testicle, the outlook for growth and proper development, *with* spermatogenesis, will be increased if we get the testicle out of the inguinal canal *early,* away from trauma and possible harm with subsequent orchitis. With the testicles lying in the bottom of the scrotum, where they are normally secure, every possible chance for later development and growth at the time of puberty will be given.

This chapter, however, is not a closed one and only further studies and follow-up examinations will teach us at what time the operation of orchiopexy will yield the best results; but let us emphasize again that an operation is indicated.

Fig. 17. Fig. 18. Fig. 19.

Fig. 17. Same case 5 months later just before second stage of operation.

Fig. 18. Ten days after second stage of operation. Testicle now lies well in bottom of well formed scrotal sac.

Fig. 19. Same case, lateral view.

### ESSENTIAL FACTOR FOR A SUCCESSFUL OPERATIVE RESULT

Certain essential factors must be fulfilled when we operate to correct undescended testicles, be the condition unilateral or bilateral, if we are to call the operation a success. These factors are:

1. The testicle, already hampered by histological changes, must be given every possible chance to develop, grow, and functionate; it must not atrophy. Therefore, of prime importance is the complete preservation of its blood supply—the spermatic artery and veins. Of course, the artery of the vas must be preserved and the nerves if possible.

2. We must bring down the testicle to its normal position in the bottom of the normal scrotal sac, without exerting undue traction upon the spermatic cord structures. The testicle must not be made to lie in the neck of the scrotal sac, just outside of the external abdominal ring and against the pubic bone.

3. A normal scrotal sac must be formed out of an often small, atrophic, and rudimentary scrotal pouch, so that the testicle can maintain its position in the bottom of the sac, and hang down where it is safe from injury and pressure against the pubic bone. The scrotum must be so stretched that it will not contract again and bring the testicle up against the pubic bone as its final position.

4. The testicle must of its own accord become fixed in the bottom of the newly formed scrotal sac, and thus not retract into the neck of the scrotal sac, or just outside of the external abdominal ring, or even retract into the inguinal canal.

5. The concomitant hernia must be cured.

6. The operation must be surgical in its principles, free from the use of foreign bodies, with danger of infection, and possible subsequent sloughing of the testicle.

7. The operation must be applicable both to unilateral as well as bilateral cases.

8. The late results must be as satisfactory as the early postoperative results.

### TREATMENT

It is interesting to follow the evolution of the treatment of undescended testicle in reading the vast literature on this subject. At this time and place we can only touch on some of the important basic principles that are involved.

It is more than a hundred years ago that Koch, Rosenmerkel, 1820, and Chelius, 1821, fixed the testicle in the scrotum. That was before the time of antisepsis and many patients died from the suppurative peritonitis that followed the infection of the processus vaginalis, which was continuous with the peritoneal cavity. This fact soon caused

Fig. 20.

Fig. 21.

Fig. 22.

Fig. 20. Case of bilateral undescended testicle 5 years after operation showing both testicles in bottom of well formed scrotal sacs. Operation at age of 12. (Dr. Torek's case.)

Fig. 21. Case of bilateral undescended testicles 12 years after operation. The patient is now 34 years old, is a married man and is the father of one child. (Dr. Torek's case.)

Fig. 22. Case of bilateral undescended testicles 17 years after operation. Note that testicles have remained in bottom of a well formed scrotum. Patient is now 29 years old, and is married. (Dr. Torek's case.)

surgery to be abandoned, and recourse was had to the construction of all types and forms of trusses. Chassaignac and Svitzer, 1841, wrote about these, and Trèlat devised a fork-like apparatus that was to hold the testicle down. McAdam Eccles, Zeis, and Englisch continued the practice. These trusses caused orchitis, and soon were listed as contra-indicated methods of treatment. Hereupon followed Langenbeck's advice to treat undescended testicles with massage. With this treatment very good results were seen in some cases, but of course this did not cure the hernia. Finotti, Lanz, and Heidenhain also strongly advocated this treatment. Then surgery again came forward and Rizzoli first advised pro-peritoneal reposition of the undescended testicle in 1855. Ordione and Simmons, Rotter, Corner, Eccles, Lotheissen, Vidal, Schoenholzer, and Hofstaetter are strong advocates of this method of procedure. Corner and Eccles mention especially that it is the best way to assure cure of the hernia, but Rawling and Ziebert point out that it is mainly contra-indicated because the chance of torsion of the cord, with its consequences, is greater. Steinmann was the first to replace the real testis with a paraffine testicle in the scrotum. This procedure of course has definite and marked contra-indications.

Another large group of surgeons favor semi-castration, and some even have gone so far as to do a bilateral castration for bilateral undescended testicles. There are three main reasons given for this procedure. The first is fear of malignancy; the second, the usual poor results of orchiopexy; and third, the sure closure of the hernial aperture. It was regularly performed and advocated by such men as Baevon, Dupuytren, Marjolin, Szymanowski, and Hodgson, while there are a great many other surgeons who are inclined to castrate only under certain circumstances. Semi-castration was opposed especially by Vilemin, Broca, Tuffier, Ziebert, Finnotti, Bevan, Coley, Villard, Wolf, Championnière, Corner, and many others. We most heartily agree with these authors and add our support to Lotheissen, who said that an undescended testicle should not be treated differently from a testicle in the scrotum. If there is malignant degeneration or other disease that necessitates removal, the testicle should be sacrificed, but otherwise it should be spared, alone for its internal secretion, if the external spermatogenesis is absent.

This then brings us to the final and important chapter of orchiopexy. Rosenmerkel and Chelius were the first to perform orchiopexy. They were followed by such men as Trèlat, Langenbeck, Anandale, Adams, Curling, Partridge, and Wood. But in all these cases infection was the unavoidable consequence. The greatest advance came in 1881 after Lister's antiseptic methods had been introduced into surgery when Schueller advised the division of the processus vaginalis. This was of great importance. The testicle could be brought down more easily but soon retracted and, having been fixed to the bottom of the scrotum, it pulled this with it and inverted the skin of the scrotum. Kocher, Nicoladoni, Tuffier, and others quickly followed Schueller's advice. Richelot was the first who applied the term "orchidopexy" to this procedure. This term as stated above has gone down throughout the entire literature. The correct term, however, is as stated, orchiopexy. Nicoladoni added a modification. He separated the spermatic vessels freely from the processus vaginalis and instead of fixing the testicle to the bottom of the scrotum, he fixed it in the perineum in order to avoid the inversion of the scrotum.

There have been so many various types of orchiopexy proposed in these many years, that a general idea of the subject may be obtained by looking over the accompanying list which was devised by Hofstaetter in conjunction with that of Lotheissen. Lack of space prevents detailed description of each type of operation.

1. Extirpation of the processus vaginalis without orchiopexy—Sergi-Trombetta, 1897.
2. Fixation of testicle in the fundus of scrotum.
   a. Original method—Rosenmerkel 1820, Chelius 1821, Anandale 1879.
   b. Separation and division of tunica vaginalis with broad fixation of testicle in base of scrotum—Schueller 1881, Nicoladoni, Czerny, Koerte.
   c. Purse-string suture at neck of scrotum near root of penis—Kocher 1887, Bevan 1899, J. Wolff 1901.
   d. Temporary transplantation of testicle outside scrotum—Hahn 1888.
   e. Excision of cremaster—Felizet 1891.
   f. Fixation after hernio-laparotomy—Kocher, Buedinger.
3. Fixation in scrotum with perineal flap covering—Hermes 1904.
4. Traction method:
   a. Traction by thread or elastic with attachment.
      1. To wire frame—Bidwell 1893, Lanz 1903.
      2. To thigh—Longard 1903, Lanz 1905.
      3. To heel—Tomaschewsky.
      4. By a stiff buried wire within scrotum—Starr 1908.
      5. Fixation of scrotum to perineum—Delbet 1906.
   b. By operative fixation to thigh.
      1. Skin, fascia-lata pedicle flap, later transplanted—Katzenstein 1902, Ordione and Simmons.
      2. Fixation to thigh with later separation.
         a. Only fixation suture—Anandale 1901, von Bramann 1907.
         b. With transplantation of testicle—Keetley 1894, Gelbke 1905, de Beule 1905, Torek 1909 (not with traction principle).
5. Perineal fixation:
   a. Nicoladoni 1895.
   b. With use of free fascia-lata transplant—Kirschner 1910, Muehsam 1911.
6. Subcutaneous fixation by suture.
   a. To pubic bone—Bayer 1896, Helferich 1899, Heinlein 1900, Gersuny 1905, Delbet 1906.
   b. To scrotal tissue—Kirmisson 1901, Cudray.
   c. To interscrotal septum—Tuffier, Championnière, Sebileau.
7. Transplantation within scrotum into opposite scrotal sac, or by fixation to opposite testicle—Walter, Gersuny 1905, Witzel, 1905, Schaefer.
8. Transplantation or burial of spermatic cord.
   a. Only inguinal canal suture—Broca 1899, Ruff 1904, Mignon, Auvray.
   b. Similar with purse-string suture at scrotal neck—Bevan 1899, Kocher, Rieffel, Doclageniere, Negron.
   c. Similar with plastic at external ring—C. Beck 1905.
   d. Similar with formation canal in scrotum—Lotheissen 1905, Czerny.
   e. From iliac brim to external abdominal ring—Davison.
9. Division of spermatic vessels, if necessary—Bevan 1903.

On looking through the literature one is struck by the fact that the authors are not satisfied with the late results of the various operations. In short, there are countless

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methods and on the whole almost universal dissatisfaction.

Bevan was the leader of the surgeons who proposed dividing the vessels of the cord and to rely on the artery of the vas to supply the testicle. He advised the usual incision, splitting the aponeurosis of the external oblique, freeing the hernial sac, ligating it, and forming a new tunica vaginalis for the testicle. "In a few cases, but these will be quite the exception, it is found, even after the free exposure of the cord, that it is not long enough to permit of the reduction well into the scrotum." In these cases Dr. Bevan advises and practices the division of the spermatic artery and veins. The testis is placed in the scrotum and in order to prevent its pulling back up into the inguinal canal he places a pursestring suture in the neck of the scrotum, thereby closing it. The late results of the operation have not been very satisfactory. It is not well to depend on the artery of the vas alone to supply the testicle, already hampered by histological changes. Atrophy and necrosis may set in. Coley reports on 415 cases in most of which Bevan's operation was employed. In his conclusions he states: "The end-results of our series show that it is possible to cure the hernia in practically all cases. Unfortunately, in only a comparatively small number of cases did we find the testicle occupying the bottom of the scrotum in the cases observed which were several years after operation.

"The atrophied testicle is generally found to have retracted to mid-scrotum or in the region of the external ring, and is in a position somewhat less liable to trauma than before operation." Moschcowitz, who some years ago strongly advocated the Bevan operation, stated before the New York Surgical Society in October, 1925, that he was very much disappointed with the late end-results, as he found atrophy and retraction of the testicle. He no longer advocates its use. It is our opinion that in some patients in which the surgeon believes that the testicle has completely atrophied, in reality it has retracted into the inguinal canal again. Mifflet, as early as 1879, strongly opposed and warned against the division of the spermatic vessels, as he had found that the procedure caused marked changes within the testicle.

An interesting point in the development of Bevan's operation is that in his first publication on the subject in 1899 he did not propose division of the spermatic vessels, but carefully isolated the peritoneal sac from the vessels and vas, and then separated the vas from the vessels. By blunt finger dissection, he then freed the vessels from the peritoneum well within the internal ring, and found that he could then bring the testicle well down onto the thigh. Making a pocket in the scrotum for the reception of the testicle he placed it there and closed the external ring by suturing the deep skin fascia to the aponeurosis of the external oblique, and placed a pursestring suture at the neck of the scrotum in order to prevent the testicle from retracting. He stated that it was not wise and not necessary to suture the testicle to the bottom of the scrotum. Although he did not say so, it may be assumed, that the late result of some of his cases was not satisfactory, and, it seems, that he blamed this upon the shortness and tension of the spermatic vessels, which he must have felt, pulled the testicle up into the neck of the scrotum. In these cases which he calls those in which "it is found, even after the free exposure of the cord, that it is not long enough to permit of the reduction well into the scrotum," he then in 1903 advised division of the spermatic vessels, a radical procedure.

We venture to suggest that had Dr. Bevan done an orchiopexy, in these same cases, with fixation of the testis and scrotum to the thigh for 6 months, it would not have been necessary to divide the vessels and deprive the testicle of so much important blood supply.

It is interesting to note that in our series of 64 operations by orchiopexy it was not necessary to divide the vessels in a single case, and our follow-up has shown that they were held down by orchiopexy, and they stayed down in the bottom of a well-formed scrotum.

The first part of Bevan's original operation, then, was similar to the first part of our procedure. Generally, among surgeons, Bevan's operation always means division of the vessels. This conception is incorrect.

### PRINCIPLES OF TOREK'S METHOD OF ORCHIOPEXY

Having gone through the sequence and development of the various procedures of handling undescended testicles, let me state at this time that every one of us, who have operated according to Torek's method, have been more than satisfied, and not in the least disappointed in either the early or the late results of the operation. In a series of 64 cases, operated on at the Lenox Hill Hospital since 1905 according to this method, we have yet to find a case in which we, as well as the patient, are not entirely satisfied with the result.

The principles fulfill the various requirements for a successful operation as enumerated above.

In no instance was it necessary to ligate the spermatic vessels. By dissecting the artery and veins free from all bands and fascial adhesions well up beyond and within the internal abdominal ring, we found it possible to bring the testicles well down *without* any undue traction.

A new scrotal sac is formed by stretching the scrotum and then suturing the incision made in it to an incision on the inner side of the thigh at a point where the testicle lies easily without undue traction. The testicle itself is sutured to the fascia lata of the thigh, and the wound in the scrotum is closed over the testicle. This is left attached for 4 to 6 months; thus the operation is divided into two stages. This gives the scrotum time to stretch and remain stretched, and the testicle and cord structures a chance to become adherent in their new relationship with the surrounding structures. In the second stage the scrotum is separated from the thigh, the testicle from the fascia lata, and the scrotum is closed over the testicle, which maintains its position in the *bottom* of a newly and well formed scrotal sac, so that it hangs freely, away from the pubic bone and trauma.

The hernial sac is totally removed and hernioplasty performed, according to Bassini, at the time of the first operation.

The operation is thoroughly surgical. No foreign body is necessary to make a pocket in the scrotum for reception of the testicle, or for traction on the testicle to keep it down. All wounds should heal by primary union in a few days, as in an ordinary hernia operation; no vital or important structure is injured or divided. In the case of bilateral undescended testicle the procedure is divided into three stages. At the first sitting the one testicle is brought down and sutured to the thigh and the hernia repaired. Four to 6 months later this testicle is separated, the opposite one is brought down and that hernia repaired. Four to 6 months later this one is separated and the patient is left with both testicles well nourished, with the full blood supply preserved, with the testicles hanging normally in the bottom of the scrotum, and with both hernias repaired. The operation is done in 3 stages as it would not be wise to attach the scrotum to both thighs at the same time.

The result of our follow-up has shown that the late results are just as good as the early result, no atrophy taking place that is not already present at the time of operation, and in some cases there has been a very definite enlargement of the testicles. The testicle always hangs in the bottom of the scrotum, free from injury and never up against the pubic bone.

It will be well to contradict a criticism at this time that appeared some years ago in Johnson's *Operative Therapeusis*. The author speaks of the Keetley-Torek operation. The procedures are somewhat alike, independently conceived, with two main differences in technique and principle. Keetley sutured the gubernaculum testis to the fascia lata of the thigh, and at times also the body of the testis itself, with the idea of lengthening the cord structures by the continuous traction. He had the patients do special exercises in order to stretch the cord. Torek, on the other hand, always sutures the testicle itself to the fascia lata of the thigh at a point where the testicle comes to lie naturally without undue traction. Therefore, the principle of traction does not apply to Torek's procedure. Technically the line of incision in the thigh is longitudinal to the long axis of the thigh in Keetley's technique, while in Torek's the incision is oblique which allows the scrotum to lie in a more

natural position and the slight pull on the testicle is more evenly distributed than if the testicle is sutured in the longitudinal position, when the pull is greater at one pole of the testis than at the other. De Beule and Gelbke who published cases operated on according to a method similar to Torek's and Keetley's also make the principle of traction an outstanding feature of the operation.

The author of the article further stated that the postoperative course is not pleasant, that the patient objects to the continuous drag on the testicle and that the gait is worse than awkward. Also that the patient is troubled by a disagreeable eczema in the skin canal between scrotum and crutch, and that the danger of infection at time of operation is not small. Finally he states that a two stage operation must not be regarded lightly. The extended experience gained at The Lenox Hill Hospital, now covering 20 years, refutes every one of these criticisms.

The postoperative course is ideal. It is just as smooth as is that in an ordinary case of hernia, and the patients are out of bed on the fourteenth day after operation with the wounds healed.

Not a single patient has complained of the drag on the testicle because this is not a traction operation. The testicle is sutured to the fascia lata of the thigh at a point where it comes to lie naturally after the cord has been lengthened by careful dissection. It is sutured to the fascia lata of the thigh in order to *keep* it down, not to *pull* it down.

That the gait is worse than awkward we can absolutely refute by stating that every one of our patients has led a normal life during the time that the scrotum and testicle are attached to the thigh. They walk, dance, jump, ride, swim, skate, in fact they do everything that any other boy or man does. Some of the patients are so comfortable that it takes a great deal of persuasion to have them enter the hospital at the appointed time for the separation operation. Two of my patients went a year between the stages because the boys had such a good time swimming during summer vacation that they preferred to miss school in winter rather than to miss swimming during the summer. Dr. Eggers had a case in which the testicle remained attached without any inconvenience to the patient during the 2 years that he was in military service during the war.

The patients are instructed to clean out the canal with soap and water when they take a bath, and we have never seen eczema as a complication.

Infection during the postoperative course is not to be feared, because the testicle is buried in the thigh and is covered completely by the skin of the scrotum and thigh, which is sutured and heals by primary union. There is practically no more danger of infection in this operation than there is in any other hernia operation.

What if the operation is done in two stages. Do we hesitate to do a prostate operation or a plastic operation in two stages if the end-result warrants it? Certainly not. The separation of the scrotum and testicle from the thigh is a simple procedure and in adults or adolescent youths is easily done under local anæsthesia. The patient is confined to the hospital for a few days only. The result of the operation is far superior to that obtained by means of other types of operation, and the principles embodied in this method fulfill every requirement for success.

### TECHNIQUE

The first stage of the operation is performed under general anæsthesia, although in adults if indicated, it may be done under local anæsthesia. The operative field is prepared by washing it with soap and water, alcohol, ether, and then 3.5 per cent tincture of iodine. Picric acid or mercurochrome may be used in place of iodine.

The usual incision is made as for a hernia operation (Fig. 1). The aponeurosis of the external oblique is incised and the inguinal canal thus laid open (Fig. 2). The testicle and spermatic cord are then dissected free all the way up to the internal abdominal ring. The chorda gubernaculi is divided close to the testicle. The spermatic cord and testicle are placed upon a moistened saline gauze compress, and the dissection of the cord structures is begun. The "envelope" of the cord is opened to reveal the contents, i.e., the

cremaster is split lengthwise from the testicle down to the internal ring (Fig. 3). This discloses the processus vaginalis which is always continuous upward and opens into the free peritoneal cavity. The vas deferens and spermatic vessels and the genital nerve are recognized, and by careful dissection the vas and vessels can be stripped off from the outside of the peritoneal sac, which in children is sometimes of tissue paper thinness. This step may be somewhat difficult but can always be executed. The vessels and vas may be spread out fan-shaped over the sac. The tunica vaginalis, or in other words, the lowest end of the congenital hernia, is cut close and entirely free from the testicle, and the structures are separated at the internal abdominal ring so that the spermatic vessels are above, running upward under the internal oblique and transversalis muscles, and the peritoneal hernial sac is in the middle, while the vas is in the lower end of the ring, passing downward and inward toward the posterior surface of the bladder to the seminal vesicles (Fig. 4). The next step is to separate the vas from the vessels all the way from within the internal ring down to the epididymis. Thereupon the dissection of the spermatic artery and vein are undertaken. This step is of prime importance and is not difficult, if it is carefully and gently and patiently performed. From the insertion of the vessels in the upper pole of the testicle, the vessels are separated and freed from all fascial bands so that they lie free from connective-tissue strands and adhesions. This is carried up to the internal abdominal ring where the vessels disappear under the muscles within the abdomen in an upward direction. A hernia hook, or McBurney retractor is placed in the internal ring and this is retracted upward, allowing access to the vessels as they pass upward between the lateral pelvic wall and the peritoneum. The careful dissection is carried on as far as possible by gently stripping the vessels and freeing them with the finger, bluntly, as far as the finger can reach, at times snipping a strip of fascia with the scissors if necessary (Fig. 5). The hernial sac is now transfixed, ligated high up, and the surplus resected. It is possible to reach with the finger retroperitoneally into the abdominal cavity and lengthen the vessels sufficiently so that the testicle can be brought down by gentle traction to its normal position and will stay there of its own accord. Ferguson has advised ligating and dividing the deep epigastric vessels at the lower border of the internal abdominal ring so that the spermatic vessels may pass in a more direct way toward the pubis. This could be done but the vessels are of some importance in supplying the abdominal musculature and we have not found this procedure necessary in any of our cases. All cremasteric fibers are resected so that only the testicle with the vas and its artery are left running to the lower pole and the spermatic artery and veins to the upper pole (Fig. 6).

At this point an incision about 1½ inches long is made on the inner surface of the thigh, obliquely from above, downward and inward at a point where the testicle is found to lie without undue traction. It is deepened down to the fascia lata and care is taken to avoid injuring the internal saphenous vein. Now the fingers are inserted into the scrotum from the inguinal wound, and the scrotum is stretched. An incision is made in the lower outer portion of the scrotum, also about 1½ inches long, and is carried through the layers of the scrotum into the cavity formed by the fingers from above. The posterior edge of the scrotal wound is sutured to the upper edge of the thigh wound. As the suture and knots are later inaccessible, No. 0 chromic catgut is used as suture material. Interrupted sutures are placed in the following manner: beginning at the lower, inner angle, the suture is passed through the wall of the scrotum, and enters close to the skin edge and emerges at a distance from the skin edge, then enters the cut surface of the thigh wound at a distance from the skin edge and emerges exactly at the skin edge. When this suture is tied with the knot outside it brings the skin edge of the scrotum to the skin edge of the thigh in exact apposition, so that inversion of the skin edge does not take place (Fig. 7). The entire posterior row of sutures are now similarly placed, and tied, and the wound will heal by primary union and the

sutures will not have to be removed (Fig. 8). The testicle is brought down from the inguinal wound into the scrotal wound by grasping the tissue around the testicle with a Carmalt clamp passed from below (Fig. 9). The testicle is sutured to the fascia lata of the thigh with 2 or 3 No. 1 chromic catgut sutures, which pass through the tunica albuginea of the testicle. We have never seen any harm come to the testicle from this procedure (Fig. 10). The lower thigh wound is sutured to the scrotal wound over the testicle, which is buried with interrupted black silk sutures, care being taken to get exact skin edge approximation (Fig. 11).

The next step is the hernioplasty. In most of the cases, it will be best to place the Bassini sutures in such a way that the spermatic vessels and vas are buried and emerge over the crest of the pubis (Ferguson). This will completely close the internal ring (Fig. 12). In some cases we have also added the transversalis fascia suture to reinforce the floor of the inguinal canal. Thus the conjoined tendon is sutured to Poupart's ligament. The aponeurosis of the external oblique is sutured (Fig. 13). The skin is closed with interrupted silk sutures.

The canal between the scrotum and thigh is dressed with a strip of gauze on which some sterile dusting powder has been applied, thus covering and furnishing dressing for the posterior suture line (Fig. 14). The remainder of the wound is dressed as in the usual hernia operation. In order to prevent undue tension on the suture line immediately after the operation, it is well to fasten the thighs together by placing a towel around the thighs just above the knees. This can be removed after the first dressing in children and earlier in adults.

The first postoperative dressing should be done on the fourth or fifth day. The dressing on the posterior scrotal suture line is replaced by a new one. The remainder of the dressings are similar to the routine followed in hernia operations.

The second stage of the operation, performed from 4 to 6 months after the first is very simple. Either under general or local anæsthesia the scrotum is separated from its attachment to the thigh and the testicle is carefully dissected from the fascia lata to which it is usually firmly adherent. After making a little pocket in the bottom of the scrotum to receive the testicle, the skin of the scrotum is sutured over the testicle, care being used to secure a good skin edge apposition. The wound in the thigh is sutured and small dressings applied. The patient can be up and around in a day or two and is confined to the hospital only for 3 to 4 days. It will be found that the testicle lies in the bottom of a well formed scrotal sac and has no tendency to retract.

## STATISTICS

Since 1905 to date 64 operations according to Dr. Torek's technique have been performed at The Lenox Hill Hospital. Of these 48 were performed by Dr. Torek, 10 by Dr. Eggers, 1 by Dr. Pickhardt, and 5 by myself. In all 49 patients were operated upon. Of these cases 15 patients had bilateral undescended testicles, and 34 had unilateral undescended testicles. Thirty operations according to this method were done on the bilateral cases and with the 34 unilateral operations make a total of 64.

We have been able to follow up the results in 35 operations,[1] and in every instance the testicles were well placed in the bottom of a well formed scrotal sac. In no instance had the testicle atrophied or retracted up against the pubic bone, or come to lie in the upper scrotum. Gangrene of a testicle did not occur. The hernias have remained cured. Of the cases followed, 9 patients had bilateral operations. In these the results were equally as good as in the unilateral cases. Three patients who had bilateral undescended testicle have married since operations and have led perfectly normal sexual lives. Two of these patients have not had children, but one had a healthy child 8 years after marriage.

The youngest child operated on was 3 years old and the oldest patient 38 years, a bilateral case.

The age at which operations were performed was as follows:

[1]The author wishes to express his appreciation for the kind co-operation of the Social Service Department of The Lenox Hill Hospital in following up and tracing some of the old cases.

| | Cases | | Cases |
|---|---|---|---|
| 3 years | 1 | 17 years | 3 |
| 4 yeasr | 1 | 18 years | 3 |
| 5 years | 6 | 19 years | 2 |
| 6 years | 2 | 20 years | 2 |
| 7 years | 2 | 21 years | 1 |
| 9 years | 2 | 22 years | 2 |
| 10 years | 6 | 23 years | 2 |
| 11 years | 5 | 24 years | 4 |
| 12 years | 6 | 25 years | 3 |
| 14 years | 5 | 27 years | 1 |
| 16 years | 3 | 38 years | 2 |

The age at which the bilateral cases were operated on, which are also included in the above table, is as follows:

| | Cases | | Cases |
|---|---|---|---|
| 5 years | 1 | 14 years | 2 |
| 6 years | 1 | 16 years | 1 |
| 7 years | 1 | 17 years | 1 |
| 9 years | 1 | 19 years | 1 |
| 10 years | 2 | 24 years | 1 |
| 11 years | 1 | 38 years | 1 |
| 12 years | 1 | | |

In examining these tables, it will be seen that 31 operations were performed on patients before or at puberty, and 33, or a majority, were performed after puberty. Of the operations performed on patients after puberty, we have been able to follow the result of 13 operations, and in every instance the result has been as satisfactory as in the cases operated before puberty. This speaks well for the method of operation.

The length of time that has elapsed since operation in the 34 cases that we have been able to trace is as follows:

| | Cases |
|---|---|
| 18 years since operation | 1 |
| 16 years since operation | 2 |
| 15 years since operation | 2 |
| 14 years since operation | 3 |
| 10 years since operation | 3 |
| 4 years since operation | 2 |
| 3 years since operation | 1 |
| 2 years since operation | 4 |
| 1 year since operation | 9 |
| 6 months to 1 year | 7 |

Of these last 7 cases, 5 at the present time have not had the second stage of the operation performed, but in every instance the testicle is well placed in the pocket of the thigh and when the time comes for separation, the result we feel certain will be as satisfactory as it has been in all the rest of the cases.

By deduction we may hope that the cases we were unable to trace so far are also well, and the result of the operation satisfactory. We have yet to see our first failure.

## CONCLUSIONS

1. The exact etiology of undescended and ectopic testicle has not yet been definitely settled. Many theories have been advanced. Important are those concerning the function of the chorda gubernaculi, the length of the spermatic vessels, the size of the inguinal canal, the size of the scrotum, and prenatal posture *in utero*.

2. The histological changes point to the fact that spermatogenic cells are present and functionate in about 10 per cent of all cases. The interstitial cells, which have to do with the development of the secondary sexual characteristics, are always abundantly present. These findings are almost constant, and therefore, the undescended testicles should always be saved.

3. Secondary complications occur. Malignant degeneration is not as frequent as is generally supposed, and fear of the same is no indication for orchiectomy. Chronic inflammation, the presence of a potential or real concomitant hernia, practically always present, torsion of the spermatic cord, and strangulation of the testicle, are occurrences so frequent that surgical interference is always indicated.

4. Pain is the most frequent symptom. Symptoms that occur with the complications may of course also be present. In adults psychic disturbances may occur on account of the depression that comes from the knowledge and fear of abnormal sexuality.

5. Operation is always indicated, if alone to cure the hernia. Orchiopexy should be performed at the same time. Castration is contra-indicated.

6. The best time to operate is before puberty, between 8 and 10 years of age in patients with unilateral undescended testicle, and earlier in bilateral cases. The method described places the testicle where it is free from undue trauma, and gives it the best chance to develop, grow, and functionate.

7. Torek's method of orchiopexy is the best means of curing the hernia and placing

the testicle into its normal position. It is logical, and surgical, and maintains full blood supply to the testicle which comes to lie in the bottom of a well formed scrotal sac. It is just as applicable to bilateral cases as to unilateral cases.

8. The late postoperative results are equally as good as are the early postoperative results, as is seen from the experience derived from 64 operations performed according to this technique at The Lenox Hill Hospital between the years 1905 and 1925.

## BIBLIOGRAPHY


ADAMS. Jahresb. f. d. ges. Med., 1871, ii, 194.
ANANDALE. Remarks on a case of transition of testicle into the peritoneum. Lancet, 1871, May 27.
Idem. Case in which a testicle congenitally misplaced into perineum was successfully transplanted into scrotum. Brit. M. J., 1879, January 4.
Idem. On operations for congenitally misplaced and undescended testicles. Brit. M. J., 1901.
Idem. Brit. M. J., 1902, ii, 1952.
ANSCHUETZ. Therapie des Kryptorchismus. Kong. d. deutsch. Gesellsch. f. Chir., 1909, xxxviii, 100.
AUVRAY. Cong. franç. de chir., Par., 1906, October.
Idem. Ectopie testiculaire. Ann. d. mal. d. org. génito-urin., Par., 1906, p. 1904.
ARTHAUD. Contribution à l'étude des altérations du testicule ectopique. Arch. gén. de méd., Par., 1886, December.
BARDELEBEN. Lehrbuch der Chir. u. Operationslehre, iii.
Idem. Beitraege zur Histologie des Hodens u. zur Spermatogenese beim Menchen. Arch. f. Anat. u. Physiol., 1897, Suppl.
BASSINI. Arch. f. klin. Chir., 1894, xlvii.
BASSO. Contributo alla istologia del testiculo nei casi di discesa completa del medesimo. Gazz. d. osp., 1906, No. 102.
BAYER. Zur Operation des Kryptorchismus. Centralbl. f. Kinderh., 1896, No. 9.
BECK, C. A new method of orchidepexie. New York Med. Rec., 1905.
BEIGEL. Arch. f. path. Anat., 1867, xxxviii; and lviii, 144.
BERGER, P. L'ectopie testiculaire de l'adulte. J. d. prat., 1908.
BESANÇON. Études sur l'ectopie testiculaire du jeune âge et son traitement. Gaz. méd. de Par., 1892, p. 231.
DE BEULE. Centralbl. f. Chir., 1905, p. 105.
BEVAN. J. Am. M. Ass., 1899, September 23.
Idem. J. Am. M. Ass., 1903, September 19.
Idem. Keen's Surgery, vol. iv, pp. 592.
Idem. Arch. f. klin. Chir., 1904, lxxii.
BIDWELL. Lancet, 1893, pp. 14 and 39.
BROCA. Traitement de l'ectopie testiculaire. Gaz. d. hôp., 1899, No. 34, p. 315.
Idem. Bull. de la Soc. de Chir., 1902, p. 61.
V. BRAMANN. Handb. d. prakt. Chir., 1907, 3d ed., iv, 593.
V. BRAMANN, BRUNS, GARRE, and KUETTNER. Handb. d. prakt. Chir., 1914, iv.
BUEDINGER. Die Aetiologie der Hodenretention. Deutsche Gesellsch. f. Chir., 1907, xc, 532.
BUEHLMAN. Ueber operative Behandl. u. Inguinalhern. bei Kind.
BUNGES. Deutsche Ztschr. f. Chir., 1871.
V. CACKOVIC. Ectopia testiculorum intraparietalis factitia. Liecnicki viestuik, 1902. Centralbl. f. Chir., 1902.
CHASSAIGNAC. 1838. Cited by Ziebert.
CHAUVEAU. Bull. Acad. de méd., Par., 1875, xliv, No. 24.
CHELIUS. Blutige Transplantation des Leistenhodens in das Scrotum. Handb. d. Chir., 1831, 2d ed., ii, 487, 1362.
COLEY. The treatment of undescended testicle. Ann. Surg., 1908, xlviii, 321–350; Surg., Gynec. & Obst., 1919, xxviii, 452.
COOPER, ASTLEY. Cited by Ziebert. Die Bildungen u. Krankheit. des Hodens, Weimar, 1832.
CORNER. Brit. M. J., 1904.
CUDRAY. Rev. d'orthop., 1902, No. 1.
CURLING. Die Krankheiten des Hodens, Samenstranges und Hodensackes, Leipzig, 1845.
DAVISON. Surg., Gynec. & Obst., 1911, xii, 283.
DEBRON. Gaz. heb., 1861, p. 3.
DELASIAUVE. Rev. méd., 1840. J. B. Cayol., Paris, p. 363.
DELBET. Cong. franc. de chir., Par., 1906, xix, 754.
Idem. Le Concours méd., 1908, iv, 26.
DOROFEJEW. Neues in der Med., 1910, M. 6–8.
DUPLOY. Presse méd., Par., 1899, No. 1.
ECCLES, MCADAM. Brit. M. J., 1902, ii, 1314.
Idem. Med. Press, 1902, ii, 237.
Idem. Jacksonian Prize Essay, 1903.
Idem. Brit. M. J., 1902, i, 503 and 570.
ENGLISH. Schmidt's Jahrb., ccviii, p. 301.
FELIZET. Bull. et mém. Soc. de chir., Par., 1901, 434.
Idem. J. de l'anat. et physiol., 1898; also, 1902, xxxviii.
FINOTTI. Arch. f. klin. Chir., xv, 337; also 1897, lv, 120.
FOLLIN. Arch. gén. de méd., 1851, xxvi, 260.
Idem. Bull. Soc. de chir., Par., 1852–1853.
GALIN. Centralbl. f. Chir., 1900, iv, p. 119.
Idem. Arch. f. klin. Chir., 1900, lx, 104.
Idem. Mil. Med. J., Bd., xxiii.
GELBKE. Fortschr. d. Med., 1905, No. 23, i, 665.
GODARD. Études sur la monorchidie et la crytorchidie, Paris, 1859.
GOSSELIN. Cited by Kocher, p. 578.
HAHN. J. Chir. u. Augenheilk., Berlin, 1894; Centralbl. f. Chir., 1902.
HALSTEAD. Surg., Gynec. & Obst., 1907, iv, 129.
HANUSA. Ergebn. d. Chir. u. Orthop., 1913, vii.
HEIDENHAIN. Deutsche med. Wchnschr., 1892., xiv, 320, No. 18; Verhandl. d. deutsch. Gesellsch. f. Chir., 1903.
HEINLEIN. Muenchen. med. Wchnschr., 1901, p. 82.
HELFRICH. Cited by Weissenborn.
HERMES. Centralbl. f. Chir., 1904, No. 27, p. 147.
HETZ. Zur Kasuistik malig. Tumor. bei inguinal Testik. Dissertation, Munich, 1899.
HODGSON. St. George's Hosp., 1867, ii, 67.
HOFFMAN. Lehrbuch der gerichtlichen Med., 9th ed., 1903.
HOFSTAETTER. Klin. Jahrb., 1911, xxvi, 155.
HOWARD. Brit. M. J., 1907, ii, 719.
Idem. Lancet, 1908, i, 230.
HUNTER. Observations on the state of the testis in the fetus and on congenital hernia. London, 1786.
V. KAHLDEN. Muenchen. med. Wchnschr., 1887, No. 31.
KATZENSTEIN. Centralbl. f. Chir., 1902, p. 854; also No. 52, p. 937.
Idem. Deutsche med. Wchnschr., 1902, No. 52.
Idem. Berl. klinn. Wchnschr., 1905, No. 51.
Idem. Discussion of Anschuetz's article. XXXVIII Deutsch. Gesellsch. f. Chir., 1903.
Idem. Centralbl. f. Chir., 1910, No. 31, p. 110.
Keetley. Lancet, 1893, 1894, i, 1008; 1905, ii, 279.
Idem. Tr. London. Med. Soc., 1894, xvii, 349.
KIRSCHNER. Arch. f. klin. Chir., 1910, xcii, 906.

KIRMISSON. Bull. Soc. de chir., 1889, p. 583.
Idem. Lehrb. der chir. Krankheit. angeborenen Ursprungs, 1899.
Idem. Soc. d. chir., 1901, xxvii, 428. Presse méd., Par., 1901, xix, 699.
Idem. Bull. et mém. Soc. d. chir., Par., 1912, xxxviii, 233.
Idem. Congrès franç. d. chir., 1906, October.
KLEIN. Thèse d. Paris.
KOENIG. Berl. klin. Wchnschr., 1896, No. 25.
Idem. Lehrbuch der Speziellen Chir., 1899.
KOERTE. Discussion of Wolf's article. Freie Vereinig. der Chir. 1901.
KOCHER. Krankheiten der Maennlichen Geschlechtsorgane. Deutsche Chir., 1887, l.
LANGENBECK. Cited by Ziebert.
LAUENSTEIN. Deutsche Ztschr. f. Chir., 1890, xxx, 243.
Idem. Centralbl. f. Chir., 1892, No. 30.
Idem. Deutsche Ztschr. f. Chir., xxxiii, p. 398.
Idem. Discussion of Anschuetz' article. 38. Chirurgenkongress, 1909, p. 102.
LANZ. Centralbl. f. Chir., 1905, No. 16, p. 425.
V. LENHOSSEK. Beitr. z. klin. Chir., 1886, xv.
Idem. Arch. f. Anat. u. Physiol., 1897.
LINHART. Wuerzb. med. Ztschr., 1863, iv.
LOCKWOOD. Brit. M. J., 1887, i, 444–461.
LONGARD. Centralbl. f. Chir., 1903, No. 30.
LOTHEISSEN. Ztschr. f. Heilk., 1907, Chirurgie 37.
LUCAS CHAMPIONNIÈRE. Centralbl. f. Chir., 1888, No. 34.
Idem. Bull. et mém. Soc. d. chir., Par., 1887, xiii, 658; 1889, xv, 311; 1900, xxvi, 693; 1902, xxviii, 771.
MARCHAND. Berl. klin. Wchnschr., 1900, No. 21.
MARSHALL. Hints to the Young Medical Officer. pp. 83.
MASSIE. Gaz. d. hôp., 1874, No. 33.
MIFFLET. Arch. f. klin. Chir., 1879, xxiv, 398–427.
MIGNON. Bull. et mém. Soc. de chir., 1900, No. 25, xxvi, 802; 1902, xxviii, 752.
MINERVI. Morgagni, 1900, No. 1.
MOHR. Muenchen. med. Wchnschr., 1904, No. 43.
MONOD. . ch. gén., 1880.
Idem. Bull. et mém. Soc. de chir. de Par., 1888, p. 519.
MORESTIN. Bull. Soc. anat. de Par., 1907, p. 623.
MOSCHKOWITZ. Ann. Surg., 1910, lii, 821.
Idem. Johnson's Operative Therapeusis, iv, 57.
MUEHSAM. Muenchen. med. Wchnschr., 1911, No. 20, 1107.
NEGRONI. Clin. chir., 1908, Anno 16, No. 228.
NICOLADONI. Arch. f. klin. Chir., 1884, xxxi, p. 178.
Idem. Wien. med. Presse., 1895, No. 17, p. 362.
ORDIONE and SIMMONS. Ann. Surg., 1904, December.
PARTRIDGE. Brit. M. J., 1858.
Idem. Med. Times & Gaz., 1868.
PELIKAN. Lehrbuch der gerichtlichen Medizin, 9 Aufl.
PELLETAM. Cited by Ziebert.
PUECH. Cited by Ziebert.
PLASS. Arch. f. klin. Chir., 1872, xiii, 402.
RICHELOT. Bull. et mém. Soc. chir. de Par., 1891, xvi, 274.
RICHTER. Ueber Hernien, ii, 107.
RIEFFEL. Cited by Ziebert.
RIZZOLI. Jahresb. d. Ges. Med., 1871, ii.
ROBINSON. Brit. M. J., 1899, June 10.
ROTTER. Centralbl. f. Chir., 1902, p. 203.
ROMANOWSKY. Anat. Anz., 1905, xxvi, Nos. 22 and 23.
ROSENMERKEL. Ueber die Radikalkur des in der Weiche liegenden Testikels, Muenchen, 1820.
RUFF. Centralbl. f. Chir., 1904, p. 1145.
RUSSEL. Practitioner, 1906, August.
SCARENZIO. Ann. univ. di med., Milano, 1859.
SCHAEDEL. Arch. f. klin. Chir., 1869.
SCHAEFER. Muenchen. med. Wchnschr., 1905, No. 26, p. 1245.
SCHOENHOLZER. Beitr. z. klin. Chir., xlix, p. 321.
SCHUELLER. Centralbl. f. Chir., 1881, p. 819.
SEBILEAU. Gaz. méd., 1897, No. 3, 10, i, 25.
SERGI-TROMBETTA. Morgagni, 1897, No. 6.
SONNELAND. Surg., Gynec. & Obst., 1925, xl, 535.
STARR. Ann. Surg., 1908, September.
SUTTON. Surg., Gynec. & Obst., 1910, x, 332.
SVITZER. Schmidt's Jahrb., 1841, xxxi, 205.
SZYMANOWSKI. Prager Vierteljahrschr. f. d. prakt. Heilk., 1868, xcviii, 56, 57.
TAYLOR. Brit. M. J., 1897.
TILLMANNS. Lehrbuch der allgemein. u. spez. Chir., 8th ed.
Idem. Muenchen. med Wchnschr., 1906, No. 50.
TOMASCHEWSKY. Russian Surgical Archives, 1904.
Idem. St. Petersburg med. Wchnschr., 1905, No. 21.
TOREK. New York M. J., 1909.
TRELAT. J. de méd. de Par., 1869, August.
Idem. Gaz. d. hôp., Par., 1882, lv, 369.
TUFFIER. Gaz. d. hôp., 1896, No. 38.
TURNER. Ztschr. f. orthop. Chir., 1910, xxvii, 22.
UFFREDUZZI. Arch. f. klin. Chir., 1913, c and ci.
VIDAL. Traité de patholog. externe. 2d ed., vol. v., Paris, 1846.
VILLEMIN. Bull. d. Soc. d. pédiat., Par., 1899, i, 14.
VILLARD. J. de méd. de Bordeaux, 1895, No. 47.
Idem. Cong. franç. de Chir., 1906, October.
WALKER. Internal secretion of the testis. Lancet, 1924.
WALTER. Centralbl. f. d. Krankh. d. Harn- u. Sex.-Org., 1903, xv, 232.
WAR DEPARTMENT, U. S. A. Defects found in drafted men. Statistical information compiled from Draft Record, 1920.
WINIWARTER. Handbuch der Urologie.
WILSON. Handb. der practischen Chir., iii, p. 1203.
WITZEL. Muenchen. med. Wchnschr., 1905, No. 26, p. 1245.
WOLF, J., Deutsche med. Wchnschr., 1902, No. 14.
WOLF R. Inaugural Dissertation, Leipzig, 1907.
WOLFER. Surg., Gynec. & Obst., 1915, xx, 228.
WOOD. Schmidt's Jahrb., 1880, clxxviii, 62.
WARE. Surg., Gynec. & Obst., 1915, xxi, 232.
ZEIS. Arch. f. klin. Chir., 1862, lv, 396.
ZIEBERT. Ueber Kryptorchismus u. seine Behandlung. Dissertation, Heidelberg, 1897.
ZWANZIGER. Ein Fall von angeborener perinaler Dislokation des Testikels. Inaugural Dissertation, Kiel, 1904.

# PRE-OPERATIVE AND POSTOPERATIVE TREATMENT IN PATIENTS WITH GASTRIC AND DUODENAL LESIONS

By R. FRANKLIN CARTER, M.D., F.A.C.S., New York
Assistant Professor of Surgery, New York Post-Graduate Medical School and Hospital; Assistant Attending Surgeon, Fifth Avenue Hospital

CAREFUL consideration of the salient factors necessitating surgical intervention for gastroduodenal lesions will be the means toward a further reduction in the mortality of the operative period. The term operative mortality, indicating as it does death from operation, is misleading in that the cause of death is not expressed. The period in which death took place is all the term signifies, except in those instances of death due directly to a mechanical cause.

The actual causes of death during this period compared with those during a like period in any life history are found to be very similar: trauma, starvation, infection, and chemical changes in the circulating fluids of the body. The focus directly responsible for the death may be activated, or when present considerably reactivated by the operation, but there are few deaths due to trauma only.

The operative technique having been standardized, the other factors contributing to success or failure during this period should be standardized. The skill of the operator will ever be dependent upon the individual. There are certain definite facts to be determined both before and after operation which designate the course of action in preparing the patient for so strenuous a period, in maintaining a supply of suitable raw products, and in avoiding the dangers from the disordered system of digestive mechanism and from infection.

The chemical laboratory is a necessary constituent of every hospital, and in no field of either medicine or surgery can the determinations made there upon the living organism be used to greater advantage than in gastric disturbances. Familiarity with the method employed and the results obtained, and application of the knowledge gained should be the duty of the surgeon as he is in constant touch with the patient from the date of the decision to operate to the day of discharge, and on any of those days the laboratory may be used to advantage in determining the status of the patient.

## PRE-OPERATIVE TREATMENT

Important features to be determined before operation are mainly those pertaining directly to changes in the physiology of the individual, either chemical, the result of the disease process having destroyed the function of a portion or all of the organ, or mechanical, the result of direct interference with the anatomical function.

*Obstruction.* The presence of obstruction may be determined by the X-ray and by a history of vomiting. It has an important bearing upon the selection of a proper surgical procedure. When present, local changes are found, the chief of which is the influence upon the infective nature of the contents of the stomach. The normal stomach, when empty, will become sterile in 5 hours from the bactericidal action of the acid secretion. In the event of obstruction with accumulation and stagnation of foreign material, this function is materially interfered with, to such an extent that gastric lavage becomes most important. Repeated washings with the stomach tube, 2 and even 3 days before operation, are necessary, twice or three times a day or until the collected grayish decomposed food substance no longer shows in the washings. Solutions used should contain dilute hydrochloric acid 20 minims to the quart.

*Hydrochloric acid content of stomach.* The amount of free hydrochloric acid present in the stomach content after a proper test-meal is the best chemical indication of the function of the organ. In the absence of free hydrochloric acid, infection of the wound by contamination with stomach contents may be expected and avoided by the proper cleansing and addition of hydrochloric acid by mouth. Both in the water used in lavage and in that

taken as drink, 6 drops to the ordinary glass of tap water is used. When hydrochloric acid is present in normal or excessive quantities, simple gastric lavage 5 hours before operation to cleanse the stomach suffices.

*Examination of the blood.* Two main causes for anæmia occur. Attention has been called to that peculiar type of anæmia resembling the pernicious form which accompanies cancerous growth in the cardia and cæcum. Thus in pernicious anæmia from a gastric lesion, resections of a large area of stomach are inadvisable until the anæmia is treated by more than the ordinary simple replacement of blood. Transfusions moderate in amount, and repeated two or three times over a period of 2 to 3 weeks, greatly reduce the possibility of death from shock, infection, and cardio-renal failure.

That type of anæmia occurring with lesions of the pylorus or duodenum is consistent with the ordinary type following hæmorrhage from any point and may be safely controlled by one or two transfusions simply to restore bulk in blood.

*General metabolism.* Changes in metabolism, while constant in effect, may be occasioned by very different causes. However, there is one cause we may be sure of from the application of the simple law of supply and demand. Energy in an appropriate form is more important in the struggle for recovery than an accurate surgical technique.

No patient except in the extreme emergency of a ruptured viscus should be operated upon for a gastric lesion until knowledge has been obtained of the blood sugar, urea, chlorides, and carbon dioxide combining power. From these determinations an insight into the state of nutrition may be had.

*Acidosis.* A low carbon dioxide combining power, below 40, indicates an acidosis which is equivalent to starvation. To operate when the carbon dioxide is below 40 invites trouble, because the anæsthetic and the trauma of operation will further reduce the carbon dioxide; and symptoms of acidosis begin to appear when it reaches 35. If there is no other contra-indication, operation should be delayed, sugar administered by mouth to raise the carbohydrate reserve, and soda bicarbonate given in 4 gram doses daily until the carbon dioxide combining power is above 50. When delay is contra-indicated, as in instances of ruptured viscus or duodenal obstruction, glucose should be administered either subcutaneously in 3 per cent solution, intravenously in 5 per cent solution, by rectum in 10 per cent solution, or by a combination of these methods. When the carbon dioxide is below 30, glucose 3 per cent and soda bicarbonate 1 per cent should be administered in 800 cubic centimeter doses until the carbon dioxide is 50.

*Alkalosis.* High carbon dioxide combining power above 65, indicates an alkalosis and in such patients may indicate vomiting with a loss of hydrochloric acid, taking of large amounts of soda bicarbonate as in Sippy diet, or duodenal obstruction in a late stage. The correction of a high carbon dioxide or an alkalosis is not obtained as readily as in the condition of low carbon dioxide. It is never wise to operate in any emergency, except a ruptured viscus, with a carbon dioxide combining power above 80. To reduce the carbon dioxide, sodium chloride given intravenously in 2 to 4 per cent solution in doses of 1,000 cubic centimeters should suffice in patients with obstruction. In those having had a long course of Sippy routine, the alkali should be discontinued 1 week before operation and a regular diet prescribed. In patients having vomited because of a stomach intolerant to food, alkalosis is unusual but may occur. It can best be relieved by giving hydrochloric acid by mouth and rectum 15 minims to 6 ounces water, and sodium chloride normal solution subcutaneously 2,000 cubic centimeters daily. Hydrochloric acid is said to benefit all cases, but in the presence of obstruction it cannot be relied upon solely, so that sodium chloride has been the chief agent relied upon.

*Twenty-four hours preceding operation.* Catharsis either mild or drastic is indicated no more in patients under preparation for operation upon the stomach than in those under preparation for amputation of the leg. In either instance it may be indicated because of constipation but in neither for preparation of the field. Catharsis is contra-indicated in

the 24 hours preceding operation because the distention of intestine from fæces will not interfere with operation upon the stomach and it will deplete the body of fluid, render the intestine more susceptible to external irritants, cause distention with gas which may interfere with the operation, and be the direct cause of postoperative distention, gas pains, and constipation.

*Gastric lavage.* In preparing the utensils for gastric lavage, the tube and water containers should be sterilized. Ordinary tap water with the addition of hydrochloric acid 20 minims to the quart may be used without fear of introducing pathogenic organisms. In all except emergency cases the last lavage should be done 5 hours before operation. Soda bicarbonate solutions occupy a popular place in the choice of solutions for gastric lavage but there seems to be no reason for their use.

*Feeding.* Feeding in the patient without an evident disturbance of nutrition sufficient to have altered the carbohydrate reserve should go on as usual until 8 hours before operation in cases with non-obstructive lesions. In those with obstruction, fluid with carbohydrate should be administered in the form of tea, orange juice, ice cream, sherbet, eggnog, etc., during the first 16 hours of the 24, even though gastric lavage is being practiced twice daily. Feeding should take place 1 hour after lavage, nothing should be taken into the stomach after the last lavage, and the mouth may be rinsed during the 24 hours. If food cannot be taken by mouth because of obstruction, it should be administered subcutaneously in 3 per cent glucose and normal saline. Except in the form of a retention enema, food by rectum is a disturbance, the quantity absorbed is always doubtful, and few patients sleep well after such an enema.

*Cleansing the mouth.* To brush and scrub the teeth of the average stomach patient stirs up trouble; gargling is equally futile. Sterilization of food and water is a reflection on the food in the face of the normal flora of mouth and nasopharynx.

*Enema.* A warm soap suds enema 4 hours before going to the operating room satisfies the patient that something is being done for his preparation. However, if the enema is medicated or not entirely expelled it is apt to be a source of irritation during and after operation.

### POSTOPERATIVE TREATMENT

The patients may be divided into two groups, those who have been properly studied and those who come as emergency cases without diagnosis. The former group may be put upon a routine which is based upon experience, the type to which they belong, the necessity for immediate feeding, or the provision for sufficient fluid to maintain a normal metabolism having been determined previously. The type of operation will determine the method of feeding. Then the patient may be said to be under control and allowed to proceed without fear of the usual complications. In the latter group, regardless of the apparent condition of the patient, the first necessity is for a blood determination of the urea, sugar, and carbon dioxide.

*Pain.* Out of the stupor of ether patients realize pain before gaining their full faculties and may react in various ways. Regardless of this reaction pain should be prevented by an injection of morphine before consciousness begins. With the first movement, in the presence of regular respiration and pulse, a hypodermic of morphine, 1/6 grain for adults under 150 pounds and 1/4 grain for adults over 150 pounds, should be administered to prevent a stormy awakening. This enables a patient to go from the sleep of ether into that of morphine and the dose should be repeated in 1/8 grain injections for the former and 1/6 grain injections for the latter, often enough to insure sleep or quiet for the first 8 hours. Pain, either spasmodic or continuous after this time, unless induced by some movement, is an indication of a complication either in the operative site or at a distance.

*Restlessness and general discomfort.* Restlessness is a very important symptom, being an evidence of hæmorrhage or of fluid starvation. It is not a symptom to be relieved by morphine or other sedative unless the patient is to be tided over the period necessary for the institution of measures for permanent relief. That feeling of unrest associated with aching of the entire body most often called a

miserable feeling, is truly one of the greatest hardships imposed upon a patient in the post-operative period. The pulse, temperature, and abdomen appear normal, yet the patient complains of being miserable. Impatience will not help them, neither will induced sleep refresh them. Their greatest desire is for a long drink of something acid. The drink of tap water, if they knew it, is the only thing that could satisfy them. It is hunger and truly the greatest manifestation of hunger, because the tissues are themselves literally crying out for fluid. In a nervous, restless, and too often called foolish patient, supplying this need in the best way will bring instant and permanent relief. In some instances morphine or codeine is an advantage but only after the water need has been supplied.

*Position.* As soon as the patient is quiet, the head of the bed should be raised and the foot rest put in place. This allows the stomach to function in the way most surgeons count upon either wholly or in part, by gravity. It is the position of choice regardless of the type of operation.

*Pulse.* The nurse in charge should be required to take and record the pulse every hour during the first 6 hours. Thus, in the absence of vomiting of blood, immediate post-operative hæmorrhage may be suspected before it reaches a dangerous stage.

*Feeding.* No food by mouth for 12 hours is unreasonable and very inconsiderate unless prescribed for some other reason than that it might leak out through the suture line. With the usual opening in the stomach for emptying the contents into the intestine, it is inconceivable that leakage could occur through an area which gets weaker by degrees up to the tenth day when fibrous union sets in. Therefore, after the first 4 hours water by mouth with sugar and some form of flavoring, as tea, is indicated in quantities which will not distend the stomach. Two to three ounces every 3 hours will quench thirst, add to the energy supply, and furnish that all-important substance, fluid. By rectum, in a tolerant patient, and only in a tolerant patient, water and glucose—4 ounces water, glucose 4 per cent, will be an added advantage. Hypodermoclysis is not indicated during the first 24 hours in properly prepared patients unless they are very emaciated with few tissue spaces, and the usual water reservoir missing or very much curtailed. In extremely emaciated patients, acidosis with its attendant vomiting is so frequent that during the second 12 hours, 1,000 cubic centimeters of normal saline and 3 per cent glucose should be administered subcutaneously. By these methods fluid by mouth 6 ounces, by rectum 16 ounces, should be administered, and any need made up immediately and without hesitation by hypodermoclysis to any amount up to 2,500 cubic centimeters with carbohydrate 300 calories.

In the second 24 hours the store of carbohydrate utilized during the first 24 hours must be replenished and a sufficient amount added to enable the patient to combat with energy combustion those tissue toxins which are picked up and must be destroyed. The rise in temperature on this day indicates this need. Because of the profuse sweating and blood loss, the fluid reserve is drawn upon more during the first 24 hours than the second 24. And the chief need is for replacement of the reserve in addition to provision for the extra amount used in the destruction and excretion of toxins.

Œdema of the stoma or of the natural opening from the stomach may interfere with the usual emptying time for fluids. Because of this danger from distention the intake should still be fluid with as much soluble carbohydrate as the patient will tolerate. Too sweet substances have a tendency to sicken the patient at this time and tea may not be sufficient to camouflage the sugar. Coffee, lemon as lemon phosphate, or orange as phosphate may be substituted except in the presence of a hyperacidity which will preclude the use of all acids or other stimulants other than tea.

Feedings of fluid flavored and sweetened according to taste are given in 3-ounce doses every 2 to 3 hours but discontinued for 4 to 6 hours when nausea or epigastric distress appears. If the distress or nausea has not disappeared after 6 hours the stomach should be lavaged with the tube and feedings resumed in 1-ounce doses every 2 hours and another trial made in 8 hours if the stomach does not

rebel at the smaller amounts. Fluid by rectum is never indicated on this day. Supplementary to the oral administration, hypodermoclysis of 1,000 to 2,000 cubic centimeters of normal saline and 3 per cent glucose should be administered to all who vomit, are nauseated, or who appear emaciated.

The total fluid intake for the average weight should be 2,000 cubic centimeters, the total food intake, chiefly carbohydrate, 400 calories. Still the fat is being called upon to support the energy requirement in the main, and acidosis now becomes imminent. A mild form usually ensues, but the patient recovers gradually during the next few days when carbohydrate in larger quantities can be given, in case of vomiting or failure in the administration of glucose. The blood should be tested for carbon dioxide at this time. Should the carbon dioxide be below 40, glucose 3 per cent to the water saturation point, or all that will be readily absorbed from the tissues should be administered subcutaneously; and should it be below 30, 5 per cent glucose should be used intravenously in 500 cubic centimeter amounts to restore the proper metabolic sugar fat ratio. Should the carbon dioxide be below 30, soda bicarbonate in 10 grain doses, dissolved in tap water, should be given by mouth every 4 hours. An additional 1 to 2 per cent is used in the solutions given intravenously. This will aid in re-establishing the acid alkali balance.

All fluids should be given either cool or warm, that is, above 60 degrees.

On the third day, the feeding of food and fluid should be continued in liquid form. If the feedings on the second day have been well tolerated, it is evident that the opening from the stomach is patent and the amount and frequency but not the density of the food may be increased. Tea, tap water, and orange and lemon phosphate in 4 ounce amounts are given every 3 hours.

The fourth day feedings, following the successful taking of liquid, should be made up of peptonized milk, thin gruels, custards, and junkets with cream and sugar, the amounts being 4 ounces, every 4 hours, with fluid *ad libitum*, the total not less than 1,500 cubic centimeters.

The fifth day feedings should be double: baked potato with butter, soft toast, cereals, gruels, purée of peas, spinach, in 5 feedings of 4 ounces. At least 1,000 cubic centimeters of water should be taken *ad libitum*.

Sixth to fourteenth day. Feedings up to this time have been small in amount and in liquid form because of the possibility of obstruction to the outlet and for fear of a gastric retention. The patency of the stoma having been well established, the danger of leakage through the suture line remains. This danger is greatest from the sixth to the twelfth day and is to be guarded against by feeding small amounts. This food should be made up of starch as a base with sufficient fat and other substances to be palatable, all foods to be finely divided. To the fifth day's feeding may be added a poached egg and minced chicken. The feedings are given 5 times a day, 5 ounces. Upon the appearance of nausea, heaviness in the epigastrium, eructations of gas or food, or a rise in pulse, all feedings should be stopped for 4 hours, at the end of which time, the symptoms remaining, a gastric lavage should determine the gastric residue and dilatation.

After the fourteenth day the patient may be considered to have entered the follow-up period and be put upon the follow-up diet, which should be rigidly insisted upon for 3 months.

8 A.M.

Milk—ounces 4, cream—ounce 1, to be taken with meal.
Cooked cereal with cream and sugar, one bowl.
Poached or soft-boiled egg.
Apple sauce, stewed pears, or stewed apricots, one portion.

11:30 A.M.

Milk—ounces 4, cream—ounce 1.

1 P.M.

Milk—ounces 4, cream—ounce 1, to be taken with meal.
Soups—creamed vegetable.
Scraped or ground lamb or beef, minced chicken, or heart of lamb chop.
Vegetables—mashed potatoes, macaroni, rice, mashed peas, creamed celery, or asparagus.
Dessert—custard or pudding with cooked fruits.

3:30 P.M.

Milk—ounces 4, cream—ounce 1.

7 P.M.

Milk—ounces 4, cream—ounce 1, to be taken with meal.
Soup—creamed vegetable.
Vegetables—rice, macaroni, cereal, any form of vegetable purée.
Egg—one, any way but fried.

After 3 weeks any cooked and finely divided vegetables should be taken, with the exception of onions, beans, cauliflower, cabbage, beets, and rhubarb.

Changes in the administration of this diet will very frequently be necessary after the first month, but additional variety should not be permitted and the evening meal should remain as light as that prescribed. An additional glass of milk or milk and crackers may be added, to be taken one hour before retiring, should the patient be troubled with night hunger.

*Catharsis.* Milk of magnesia in amounts of 1 to 2 ounces in 24 hours is an excellent remedy in that it soothes the hyperacidity and controls the constipation. It may be given during the second 24 hours or thereafter daily without fear of its chemical or drastic action.

COMPLICATIONS

*Hæmorrhage* into the stomach or intestine always occurs in some quantity. Vomiting of serum with clots, dark coffee-ground material or a liquid, foul smelling, dark colored material is a frequent occurrence. But if there is a rapid and marked increase in pulse with or without vomiting of blood within the first 5 hours, gastric lavage offers a sure means not only of showing up the hæmorrhage but of stopping it. Frequent lavage with water at 100 degrees F., every precaution being used to leave the stomach empty, is the best means for checking hæmorrhage within the first 12 hours. When hæmorrhage is evidenced by a rise in pulse and gastric lavage is delayed for 24 hours, a large amount of very dark, foul, distinctly toxic material is returned. Signs of bright blood in the lavage after three lavages repeated at 2-hour intervals indicate hæmorrhage which had best be controlled by the usual surgical measures; however, in rare instances will active bleeding be found upon opening the abdomen. Upon signs of hæmorrhage continuing to the danger point, transfusion will leave the patient in much better condition than the re-opening of the abdomen. Re-opening is indicated only when there are signs of hæmorrhage such as a rise in pulse with or without evidences of the usual oozing into the stomach. This oozing is from the washing in patients with large resection of the gastric mesentery. In these cases the hæmorrhage is extragastric from the main arterial supply.

*Vomiting.* While vomiting remains a symptom in this instance, its various causes may best be classified according to the character of the vomiting and its expectancy.

Persistent vomiting in the first 24 hours usually indicates hæmorrhage; and the blood does not necessarily have to be bright red or clotted to denote a steady ooze from the stomach or intestinal surface. Blood in the stomach from an oozing surface does not clot and it decomposes within a few hours. Autolavage is never indicated for any type of vomiting after operations upon the stomach or duodenum. The extent of gastric distention before the lavage is given cannot be estimated, therefore an increase in the distention by the addition of warm fluids in 8 to 10 ounce quantities as an autolavage is very dangerous. Autolavage is never as certain as gastric lavage with a tube.

When a gastro-enterostomy or a Pòlya has been performed, vomiting of bile after the first 18 hours indicates that duodenal contents are entering the stomach. In the presence of this very significant sign the stomach tube should be used every 12 hours. As under normal conditions there is about 1 pint of bile in 24 hours, the stomach may be allowed to contain half this amount without danger from distention. Feedings by mouth should be stopped with the exception of those immediately after and 3 hours after lavage until the return from insertion of the tube shows 5 ounces or less of bile and stomach contents. When this point has been reached, feedings should be resumed and this feeding should be checked at the end of 24 hours. Repeated gastric lavage of this sort does not lead to alkalosis unless the intake of sodium chloride and fluid is stopped. This type of vomiting

will usually subside on the third or fourth day unless it is due to some mechanical obstruction or outlet other than that produced by œdema of stoma.

Persistent and copious vomiting beginning suddenly after the stomach contents have apparently been normal for a period of 5 to 7 days indicates some form of so-called vicious circle. The chief danger is either alkalosis or acidosis. Gastric lavage should be done as often as the patient feels distended, appears so, or has rise in pulse of 20 above the average. A 1 per cent solution of warm saline in 10 ounce quantities is introduced before the return flow is released. The chloride and fluid intake should be kept up, and glucose should be administered by rectum, subcutaneously, and in extreme cases by vein. The patient should be carried 10 days to 2 weeks on this method, should no visible peristalsis or signs of distention after gastric lavage occur.

*Acidosis.* Starvation, always a problem in serious stomach or duodenal disease, is easy either to prevent or relieve. Determination is simple. Starvation may be suspected by the general appearance and confirmed both by urinalysis and blood analysis. Individuals with more than the average amount of fat are very frequently found with a serious degree of acidosis. There is not a lack of material to furnish sufficient energy by its combustion but a disproportion, viz., there is not sufficient carbohydrate to support the fat metabolism. And since the well nourished individual can store up no more carbohydrate against that period of enforced food limitation after the operation, he is little or no better risk than the thin cadaverous patient with long standing disease associated with partial obstruction.

Acidosis to some extent should be expected in poorly nourished patients, and in them it is due solely to starvation. It is of little consequence, because its presence is anticipated and it can be prevented by the adequate amounts of carbohydrate administered by mouth before operation, and rectally and subcutaneously afterward. In the well-nourished patient, acidosis is usually an acute postoperative condition. A general expression of horror is characteristic, the eyes are sunken with whites showing, and with dark moist lids. The mouth is open, sordes covered teeth appear before a tongue dry, parched, and browned by the moist acetone breath drawn rapidly back and forward in quick gasps which are frequently augmented by deep sighs ending in moans of despair much more impressive than those arising from acute localized pain. The skin is moist, dusky, and lifeless. The pulse races in small volume and is of the true thready variety. Generally there is, next to that from hæmorrhage, the most impressive type of restlessness. The restlessness in both cases is due to air hunger. This is the danger stage and occurs only in the poorly prepared or starved patient after operation, usually on the third or fourth day. The determination of the carbon dioxide content of the blood is imperative, and if it is found to be below 30, glucose 3 per cent and soda bicarbonate 2 per cent in 800 cubic centimeter amounts are administered intravenously every 5 hours, until the carbon dioxide is above 35. After this point is reached, the subcutaneous administration of 3 per cent glucose, 10 per cent glucose and 4 per cent soda bicarbonate by rectum, and glucose in all foods should be used.

*Alkalosis.* In those patients formerly signed out as cases of cerebral embolism or cerebral hæmorrhage on whom no autopsy was performed, there must have been many instances of alkalosis; for the symptoms are usually cerebral with the same terminal hyperpyrexia. During the past 3 years one patient after another with cerebral symptoms has shown definite blood changes. In such patients the blood findings have been termed alkalosis, so that the attention in such instances is no longer focused upon the cerebral manifestations but upon the blood changes. The general symptomatic appearance of the patient in the late stages of alkalosis is as opposite to that of acidosis as are the blood findings. But the earlier stages of alkalosis, like acidosis, produce no symptoms of note. In the former this proved indeed unfortunate, for to control a case and lower the carbon dioxide from above 85 has been until recently impossible in the acute postoperative instance.

The late stages transform an individual from a state of quiet composure to one of quiet tension or twitching somnolence. The facial expression remains normal for deep slumber, eyes and mouth closed; slow, sonorous respiration; the extremities are held in tonic spasm with the knees flexed on the trunk. The tongue is moist, the eyes are rolled up, pupils normal. There may be a carpopedal spasm; however, many die without developing the typical symptom. There may be twitching or a coarse tremor of the extremities. The skin feels normal, and only as a terminal sign do the temperature and pulse rate go up to very high levels, 12 to 18 hours before death.

Treatment is both preventive and curative. The latter is uncertain and until recently there were no definite means of combat. In cases of hyperacidity due to ulcer, the carbon dioxide is almost always elevated from the taking of large amounts of soda bicarbonate. In another and much smaller group the condition is due to obstruction to the second and third portion of the duodenum. In the latter, prevention entails treatment accorded the ordinary intestinal obstruction, that is, saline infusions of 2 to 4 per cent sodium chloride in 800 cubic centimeter amounts every 8 hours until the carbon dioxide drops below 70. Hydrochloric acid by rectum is of value. Following operation, alkalosis develops in those with a pre-operative condition of this sort which was not suspected or was overlooked, and in those with partial or complete obstruction to the second or third portion of the duodenum. Treatment in mild cases should be the same as that for intestinal obstruction. In very severe instances when the carbon dioxide reaches 90 or above, sodium chloride, hydrochloric acid by rectum and mouth, and calcium chloride intravenously should be administered to the limit. Postoperative lavage does not always cause alkalosis when repeated frequently.

*Shock.* The usual type of collapse soon after operation is not peculiar to patients who have had operations upon stomach and duodenum. However, there is a type of delayed shock to which patients who have had an extensive tissue destroying operation upon the stomach and duodenum are more liable than are those who have had an operation to remove sections lower in the gastro-intestinal tract. Toxins absorbed from decaying tissue produce definite signs of collapse, rapid pulse, low blood pressure with cyanosis and moist clammy skin. This type of shock is noted especially after gastric resection in which crushing clamps are used. On the second or third day after such an operation the patient may show signs of shock for no apparent cause. Frequent gastric lavage with the tube and the use of large amounts of warm saline solution will give great relief by emptying the stomach of blood clots, sloughing, and partly digested raw surfaces and the serous discharges from these raw surfaces which if not removed pass into the intestine and are rapidly absorbed.

*Intestinal obstruction.* Besides the so-called vomiting from a vicious circle, there are two definite forms of intestinal obstruction following operations upon the stomach and duodenum: obstruction of the jejunum or ileum. The former is usually due to the slipping of a loop through an opening in the mesentery of the transverse mesocolon such as is used in making a posterior gastro-enterostomy. The one word denoting sudden complete obstruction to any part of the jejunum or ileum in these patients is shock, a term which is better applied here than in so many other instances. The patient appears to have received a death blow. There is that grayish pallor which more than any other symptom foretells impending dissolution. There is not the appearance of exhaustion found when the patient is said to be in a state of shock following either hæmorrhage or surgical trauma. The associated signs—vomiting, rise in pulse, rapid loss in weight and abdominal tenderness—may be found in other conditions and are of little specific importance in reaching a diagnosis. However, pain is a distinctive feature. It is sudden, spasmodic or continuous, difficult for the patient to describe except that it is in the epigastrium and very intense. This pain may be distinguished from the pain of peritonitis in that the respiratory difficulty due to the lack of abdominal rigidity is lacking; there is no grunting or

splitting of sentences which could ordinarily be completed in one breath.

The presence of leakage from the suture line is ruled out by these positive indications: The obstruction may occur at any time during the first 2 weeks of convalescence, the patient suffers extreme and sudden shock, there is an absence of abdominal rigidity, and most important of all, there are changes in the blood content. These take place with great rapidity and except for that are consistent with those found in the second form of obstruction. Little or no appreciable lowering of the carbon dioxide will take place and the latent period of normal urea and chlorides is apt to be overlooked on account of a delay in the taking of a specimen. There is a rapid loss of chlorides, an early rise in carbon dioxide and urea, the carbon dioxide combining power reaching, in 8 to 10 hours, that consistent with that for alkalosis in its most extreme form. Upon the blood findings alone the decision to operate may be based without equivocation. Treatment is often without avail, not because of inability to overcome the altered chemical constituents of the body, but because it is instituted after tissue destruction has set in with its attendant protein toxins, both from cell destruction and bacterial activity. The early administration of sodium chloride intravenously in 2 per cent solution and in amounts of 800 cubic centimeters should be resorted to every 5 hours. The first indication for chloride is a lowered carbon dioxide in the presence of suggestive symptoms, and upon the chloride determination will depend the necessity for repeating the infusion. Hydrochloric acid by mouth and by rectum should be administered to the limit of tolerance of the mucous membrane. Operation for the relief of the obstruction and resection of devitalized tissue have not the importance in the end-result that they were once accorded. They are necessary and vital factors, but the time element which was once the all important feature now is made to correspond more with the extent of the regional injury than with the indirect result as manifested in the constitutional outward signs of shock. Replenishing the chlorides as they disappear has become of first importance in the consideration of this critical problem. Not that operation should ever be delayed with a carbon dioxide below 90 and a chloride above 0.35, which is equivalent to saying that, so long as, from the general aspect of the case there is a chance for recovery, but that treatment in every instance of intestinal obstruction no longer begins and ends, in surgery. The operation should not be delayed and large amounts of sodium chloride infused except in those patients in whom experience has shown that there is little or no chance of recovery from operation. To relieve the patient of obstruction and to restore the blood to normal, constitute the complete treatment of intestinal obstruction. The existing difference lies in the rapidity with which these various steps must be executed.

Obstruction of the colon after operation involving its mesentery or after operation fixing a loop of intestine attached to the anterior wall of the stomach, has certain definite characteristics to make it one of the most interesting complications. Death of the colon from destruction of the blood supply should always be an immediate operative consideration, and this is not a pre-operative or postoperative problem as the terms are generally employed. Any operation in which the first or fixed loop of the jejunum is brought over the transverse colon and attached to the anterior or posterior wall of the stomach and sewn end-to-side is one of the potential causes of obstruction of the colon. Without entering into the details of intestinal obstruction in the colon more than attempting to characterize that form occurring in these instances, suffice it to say, that upon blood analysis again lies the sure means of diagnosis. Although true, this method is little tried. Vomiting of the character described, distention to the same degree, and rise in pulse may all be similar in the presence of leakage from the suture line but there will not be blood changes indicative of intestinal obstruction. In paralytic ileus the blood changes will not be consistent with the period of development and the intensity of symptoms found. In obstruction, the symptoms, pulse rise, distention and vomiting develop slowly and as the chlorides fall; in paralytic ileus, distention, vomiting, and pulse rate increase

after which the chlorides decrease, with an increase in carbon dioxide out of all proportion to the fall in chlorides, seen in the former condition.

Treatment is essentially the same as described and differs only in the time to spare or waste. The danger is late and death more remote in this type, as in other types with obstruction of the colon. Therefore, treatment is given a chance not experienced when the obstruction is higher up.

*Peritonitis.* There are two distinct periods during which peritonitis occurs which denote contamination due to intestinal or stomach contents; during the first 48 hours, the contamination may be from soiling at the time of operation, and on the ninth to eleventh day from leakage from a suture line which failed to heal before the suture material lost its function. Leakage from the suture line on the fifth or sixth day with a resulting peritonitis may follow digestion of the suture material in the buried end of the duodenum. The resulting abscess is deceptive in that the reaction is chemical, low grade, and slow in action. Death usually follows from lobar pneumonia or parotitis or the abscess may rupture through the anterior abdominal wall and eventually heal.

Sudden peritonitis on the ninth or tenth day occurs when the joined edges fail to heal. Death in 36 to 48 hours results unless the leakage is in the lesser sac, in which instance a subphrenic abscess results. An abscess anterior to the liver may result from a slow leak. Death is usual in such instances either from infection or starvation. Exceptions occur when the abscess is discovered and drained or when it ruptures spontaneously, and there is a small fistula which can be controlled with packing. Packing the sinus with plain gauze firmly, then pulling the edges together with adhesive, should be attempted early, as soon as the purulent discharge is replaced by normal gastric or duodenal content. There will be little digestion of the abdominal wall if the dressing is changed daily, the wound cleansed with alkaline solution and covered with vaseline gauze. Recovery depends largely on the nursing, as frequent and concentrated foods in small amounts must be urged upon a patient who loathes the sight of food. Frequent blood analysis, every 3 days, insures against an unexpected complication of either an acidosis or an alkalosis. Supplementing the fluid intake by subcutaneous saline should be a daily routine; glucose should not be used as it cannot be used daily for the length of time required without causing inflammation. Rectal feedings should not be used because they soon become irritating and are the cause of the diarrhœa which calls for more rigorous methods for food and water administration. The diarrhœa is either caused, or soon followed by, an acidosis which can be checked only by the administration of soda bicarbonate by mouth and alkaline colonic irrigations, and by discontinuing fat by mouth.

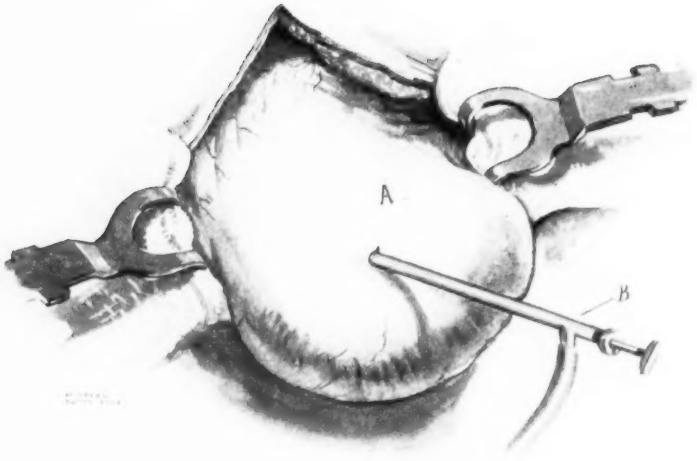



Fig. 2. The stomach, which is nearly always full of air, is emptied in order to get a clear view of the gall bladder. *A*, Stomach bulging into wound; *B*, aspirating trocar inserted into stomach.

*Cholecystectomy.—H. B. Devine.*

# CLINICAL SURGERY

*FROM THE SURGICAL CLINIC OF ST. VINCENT'S HOSPITAL, MELBOURNE*

## CHOLECYSTECTOMY

By H. B. DEVINE, M.S., F.A.C.S., Melbourne, Australia

THE technique of cholecystectomy which is here described differs from the usual in that the gall bladder is perfectly exposed by a system of very gentle, well diffused, retraction which allows the most precise dissection even in the most difficult cases, which obviates any handling of the liver, and which permits the lightest anæsthesia.

A lack of appreciation of the great exactitude necessary in cholecystectomy accounts for 75 per cent of unpleasant after-effects which, some years ago, brought this operation into a certain amount of disrepute. It is of interest from a prophylactic point of view that a series of operations undertaken by us to relieve distressing symptoms which occurred after cholecystectomy disclosed the following:

a. Pyloric stenosis caused by adhesion of the pylorus to the anterior abdominal wall, or to the liver.

b. A duodenal stenosis resulting from adhesion of the duodenum to the bare surface from which the gall bladder was removed. In these cases the duodenum was often drawn up and angulated as well as being constricted.

c. Gross duodenal adhesions which, while not causing any actual obstructive manifestation, gave rise to a dyspepsia associated with a good deal of pain which was probably caused by the dragging of a liver which was heavy, constantly moving, and firmly fixed to the duodenum, or by a strong string-like adhesion between the stump of the gall bladder and the duodenum.

All these pernicious after-effects are attributable to faulty technique and must be avoided.

### OPERATIVE DIFFICULTIES AND DISABILITIES

It is our experience that, while the common practice of handling and dragging down the liver to facilitate cholecystectomy is quite unnecessary, it causes sickness and nausea for many days after the operation.

It is also of great importance to avoid a blood-stained dissection which results from imperfect or slovenly hæmostasis because the subperitoneal extravasation of blood, in combination with the mild stimulative infection which is often present in gall-bladder cases, is the ideal condition for venous thrombosis which, if it occurs in a gastric or duodenal vein, may cause a hæmatemesis or mælena from the development of small or imperceptible acute ulcers, while, if it affects the larger veins, it may gain entrance into the systemic circulation and give rise to such serious complications as metastatic infection in the lungs with bronchopneumonia, or embolism and thrombosis of the coronary arteries with sudden death.

An operation field obscured with blood and inadequately lighted and exposed, has led, even with most competent surgeons, to such irremediable accidents as injury to the common duct, portal vein, or to the more remediable injuries of theduodenum or hepatic flexure.

Faulty hæmostasis with a blood-stained operation field is more likely to arise if the operator commences at the fundus of the gall bladder and ligates the cystic artery last. It may also arise from inaccurate dissection, a consequence of a faultily placed incision and an imperfect exposure of that most important region—the angle between cystic and common duct. The very harmful duodenal and pyloric adhesions are caused by rough handling, imperfect peritoneal coaptation and unnecessarily prolonged drainage.

I shall set out hereunder what I conceive should be the ideals of the surgeon in cholecystectomy—methods contrived to minimize the difficulties and avoid the evils I have mentioned. They are:

a. To arrange the incision and exposure so that the cystic duct, the point of great difficulty, and the "keystone" and starting point of the operation shall be the main and most accessible objective.

b. To cover the wound and peritoneal edges so that they cannot be injured or the protective

coverings disarranged by subsequent manipulations.

c. To put on the stretch the cystic duct and its artery so as to unravel their natural folds.

d. To seclude the intestines and stomach from the field of action.

e. To dissect cleanly under good vision with the aid of long handled instruments.

f. To shell out the gall bladder from its peritoneum so that all peritoneal edges can be most accurately apposed.

g. When necessary, to interpose an omental screen between the site of removal and adjacent viscera.

h. To arrange it so that the patient has the lightest and shortest possible anæsthesia in order to minimize shock and pulmonary complications.

TECHNIQUE

The following technique fulfills these surgical ideals:

*Preparation of the patient.* The ordinary routine of the patient is disturbed as little as possible. A little moderation of his usual diet and an enema to clear his colon is all that is necessary. Three coats of 2½ per cent iodine are applied to the skin on three successive hours.

*Anæsthesia.* An expert in anæsthetics can get any phase of insensibility with ether and no additional narcotic such as morphia is ever necessary. An anæsthetic trolley with every necessity for the intratracheal administration of ether stands beside the operation table. From the apparatus the anæsthetist gives ether vapor on a partially open mask. He is especially careful to have the patient well under the anæsthetic for the incision, the insertion of the special retractor (Fig. 1), and for the exclusion of the intestines from the operation field, and as lightly as possible during the main part of the operation while operating on the insensitive gall bladder, so as to reduce the amount of anæsthetic to a minimum and thus greatly diminish shock and the occurrence of pulmonary complications. This extremely light anæsthesia, while the insensitive viscera are being operated upon, is only possible with gentle manipulations and fixed, uniform, and light traction. The patient will vomit on the least rough movement—he is only asleep.

If, at any time during the operation, the respiratory movement becomes deep and exaggerated, so that accurate dissection becomes difficult, the operation is stopped, the wound covered, and intratracheal administration of the anæsthetic instituted. At once the excessive respiratory movement ceases, and operation becomes easy.

Ether is used as a routine; nitrous oxide gas, oxygen or local anæsthesia for specially debilitated cases.

*The patient is placed on the operation table* in the reverse Trendelenburg position without any pillow under the chest.

*Incision.* Since cholecystectomy rather than cholecystotomy is the operation of choice, our objective is the junction of the cystic and common duct and the right edge of the gastrohepatic ligament, 1½ inches below the ensiform cartilage. Therefore, the best incision is slightly paramedian, as high into the epigastric angle as possible and even carried a little to the left of the midline in its upper part. The muscle may be displaced, or better still, split ¼ inch from its medial edge, because this insures a little safer closure, as sutures cut out very readily from the post sheath because its fibers run transversely and the small medial piece of rectus muscle prevents this. Bleeding arteries in the muscle, which are sometimes troublesome, are controlled by an X-suture which includes the sheath as well as the muscle.

I deprecate the large incisions very often advocated for exploratory purposes because not only are they unnecessary, for adequate exploration can be made from a high incision over the cystic duct, but they weaken the abdominal wall. Removal of an adherent appendix, the only necessity as a rule for a large incision, is better made by elevating the abdominal wall from the intestines with my special self-retaining retractor and in this way finding the appendix easily when it may be drawn through a small stab wound directly over its base.

*Setting the operation field.* I attach great importance to this.

It is done by the use of a four-bladed retractor and "mechanical hands" (Fig. 1). It is better to make a somewhat smaller incision than usual in order to get the spring-like action of the muscle which retains the retractor in position (Fig. 1).

If there are no adhesions to the abdominal wall from a previous operation, proceed as follows:

Two very thick towels are laid over the wound so that they overlap at the lower angle of the wound. The frame is laid on these, and, with a left forefinger placed on the towel at this point the towel junction is tucked under the cut edge of the abdominal wall. Blade *B* is now substituted for the finger and held up by the left hand of the assistant so as to elevate the abdominal wall clear of viscera and thus enable the left hand of the operator at *C* to tuck in the towel at this point under the peritoneum, and unhampered by intestines to insert blade *C* and to lock it on the

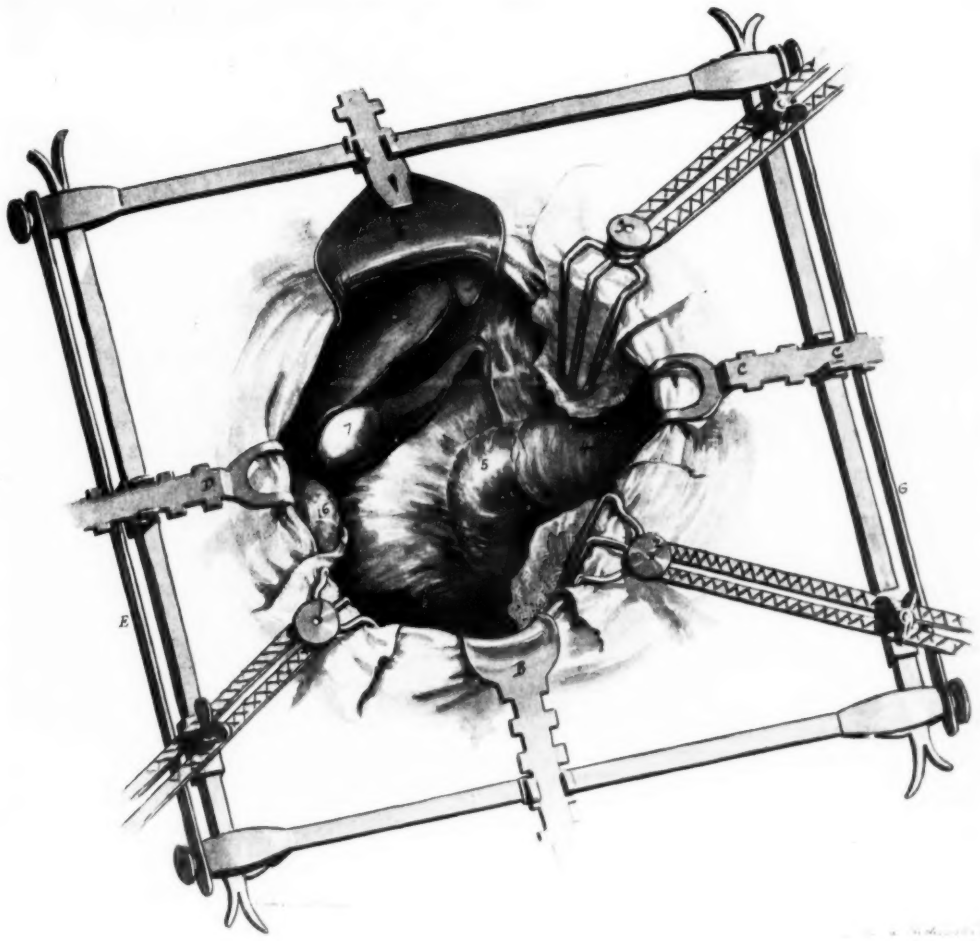



Fig. 1. Drawing showing the "setting" of the operation by means of the universal self-retaining retractor as a preparation for cholecystectomy. *a*, The wound edges are covered; *b*, the intestine, stomach, and colon are secluded from the field of operation; *c*, the duodenum is drawn downward stretching the gastrohepatic ligament. *1*, *2*, and *3* are mechanical hands; *5*, the duodenum; *6*, the hepatic flexure.

frame. The assistant, with his right hand, pulls the frame toward him and keeps it on tension at the point *E* while still retaining the upward tension on the blade *B*. This facilitates insertion and locking of the blade *D* so that the wound is widely opened under slight tension. The assistant, with his hands at *E* and *G* now lifts the frame and so allows the towel to be turned under the peritoneum in the upper angle and the insertion of the blade *A*.

The wound is now opened to its fullest extent, under slight tension only, and the wound edges, including peritoneum, completely covered without any fear of disarrangement, damage, or infection.

In secondary operations on the gall bladder in which there are always extensive adhesions, some modification is necessary. It is better at the outset to clear a little space for the blades *C* and *D*, fix them into the frame and lift the abdominal

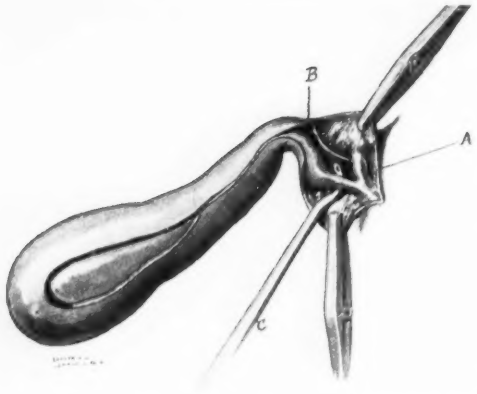



Fig. 3. Enucleation of cystic duct. *a*, Peritoneum turned back off duct; *b*, point of ligature of cystic artery as far from junction of ducts as possible; *c*, Sir Alexander McCormick dissector.

wall. This will greatly facilitate what is usually a very difficult task, the disconnection of the adhesions from the anterior abdominal wall, especially those far out from the incision. When these adhesions have been dealt with, then "set" the operation field as we have outlined.

It is at this stage, i.e., before beginning to remove the gall bladder, that the abdominal wall is lifted away from the viscera as the frame is elevated. In this way a space is created through which the operator examines the rest of the abdomen without handling intestines, removes the appendix, or accurately sutures any wounds in the parietal peritoneum of the abdominal wall.

Frequently the stomach is distended with air and bulges into the wound hampering the approach to the gall bladder. A maneuver which greatly facilitates the operation is the emptying of the distended stomach of air by means of a trocar attached to an electric pump, a suture being inserted to close the very small opening (Fig. 2).

*Exclusion of intestines from the operation field by the use of "mechanical hands."* This is a very special feature in the technique and is of great value.

Place on the viscera a large, soft scarf of single layer gauze a yard by a half a yard, lift the frame (not the retractor blade) and the scarf will be drawn into the abdomen. Draw the intestines, with duodenum protected by the scarf, over to the left with the mechanical hand *1*, which is then locked. This puts on the stretch the cystic duct and its artery and also the common duct.

Carry out the same maneuver to the hepatic flexure with mechanical hand *2* and also seclude the stomach from the operation field, if necessary, with mechanical hand *3* (Fig. 1).

The gall bladder and its ducts are now in perfect view, and, because of the reverse Trendelenburg position, under a good light and completely isolated from the mobile viscera, so that dissection, even in the fattest patient, can now be carried out under sight with long instruments with the most perfect accuracy, and there is no necessity whatever to drag down the liver as usually recommended in order to get access to the cystic duct. The gall bladder is now most accessible; indeed, in a fat patient in whom the right lobe of the liver was almost completely atrophied from an old shrunken hydatid, and in whom the gall bladder was situated almost as high as the diaphragm, dissection of the cystic duct under sight and an easy removal of the gall bladder was possible with this technique.

Any adhesions of the gall bladder to adjacent viscera should now be removed by dissection with very sharp scissors; stripping with fingers causes hæmorrhage and subsequent adhesions. The gastrohepatic ligament should be defined and the gall bladder aspirated by a fine trocar. The cystic and common duct should be palpated for stone or carcinoma and the pancreas for inflammation or carcinoma.

*Enucleation of cystic duct.* This is the keystone to the operation, for it at once exposes, indubitably, the proper plane in which the operation should be carried out. With Bard-Parker blade fitted to a long handle make an incision in the peritoneum over the cystic duct and continue it on to the common duct for about ½ inch. With a 10-inch curved scissors and a McCormick dissector (Fig. 2) isolate the cystic duct; put a traction catgut ligature on each leaf of the elevated peritoneum. By means of the dissector (Fig. 3, *c*) ligate the duct, and cut it across and put a clamp on the gall-bladder end for traction. Continue the peritoneal incision on each side of the gall bladder ½ inch from its junction with the liver and dissect up the *S* shaped part of the gall bladder, keeping very close to the duct until the cystic artery shows as it enters the gall bladder and ligate it at this level where it is out of the danger zone (Fig. 3, *B*). Now remove the gall bladder by dissecting along its subserous plane—a continuation of the plane around the cystic duct.

At this stage, examine the common duct. If it is dilated, and if the cystic duct is also dilated, remove the ligature from the latter and try to

explore the common duct with a flexible probe by way of the cystic duct for an impalpable stone. This is an easy method where the ducts are dilated, as they usually are if a fairly large stone has passed from the gall bladder into the common duct. If this exploration is unsatisfactory, make an opening in the common duct, aspirate and explore it, and, if the duct is patent to the probe, pass a No. 8 Hegar dilator into the common duct and dilate the bile papilla in order to stretch the sphincter of Oddi and obtain good drainage. If the patient has had no jaundice and no stone is palpable in the undilated common duct, then exploration with the probe is unnecessary and meddlesome.

Palpitation alone cannot be depended on to disclose a stone in the common duct, for a small stone with a surrounding area of inflammation in the pancreas cannot be distinguished from an inflamed indurated pancreatic nodule. In this case, insertion of a probe into the common duct and dislocation of the duodenum will reveal the stone.

In acute cases we now remove the gall bladder much more often than we did because by exact technique we are able to leave no bare, deperitonized areas. In the presence of much inflammation, imitate nature and "back wash" the omentum so as to interpose a screen between the liver and the duodenum and pylorus and between these viscera and anterior abdominal wall. This, though fixed anteriorly, will allow the hollow viscera to move freely on its under surface—an important point.

*Cholecystectomy in old and debilitated patients.* In many instances, either because of their great age or debility patients have been unable to take a general anæsthetic. In these, the various layers of the abdominal wall, including the peritoneum, were injected with novocain solution, the retractor gently inserted, and the subperitoneal plane round the cystic duct and margin of gall bladder injected. It was possible to remove the gall bladder without the slightest pain, the retractor giving wonderful access under these adverse circumstances—being tolerated without discomfort.

*Drainage.* It is safer in the majority of cases to drain, but in many instances when the gall bladder is only under suspicion and is removed as a precaution, drainage is unnecessary. Drainage of bile on the tenth day is an indication that the ligature has burst off the cystic duct from an increased pressure in the common duct, which is probably caused by obstruction from a small stone which has been overlooked. Because this has happened many times, even with the best of surgeons, routine drainage would seem almost imperative, though in the majority of cases it is quite unnecessary.

*Closure of abdominal wound.* The peritoneal edges are everted by continuous catgut suture. The rectus sheath is approximated by mattress sutures with an overlap of almost ¾ inch. A running suture of catgut along the edges is an additional safeguard and avoids the necessity for silkworm-gut sutures.

### AFTER-TREATMENT

The after-treatment, as a rule, gives very little trouble if the operation has been faithfully done. If the patients have much vomiting, or show any sign of gastric dilatation or duodenal ileus, we ask them to swallow an Einhorn tube, and, with this in position, they swallow quantities of water which immediately syphons back by the tube and thus washes out the stomach without the distress to the patient which vomiting entails.

Patients are allowed up in two and a half weeks and given written instructions with regard to diet and exercise.

Since I have evolved this technique which, however, has to be demonstrated to be fully appreciated, the most difficult secondary operations on the gall bladder have become comparatively easy and precise excision of the gall bladder in acute cases possible. That the retractor is tolerated without pain in patients under local anæsthesia shows that it has no shock-producing or injurious effect and I can recommend it to my fellow surgeons, not only as a means of saving the life of patients, but as a means of lengthening the life of the surgeon.

*FROM THE SURGICAL DIVISION, GERMAN UNIVERSITY, PRAGUE*

# THE TECHNIQUE OF COLON RESECTION[1]

By Professor H. SCHLOFFER, Prague, Czecho-Slovakia

THE divergent views held upon the subject of colon resection, remind one of the controversy which lasted for more than half a century with regard to the resection of the small intestine. The controversy has revolved around the question as to whether the gangrenous bowel of a strangulated hernia should be resected and sutured in a one-stage operation. For years the adherents of the one-stage procedure remained isolated. Because of the patient's poor condition and because of the damage sustained by the bowel, it seemed safer to establish an artificial anus. Only exceptionally did it prove possible to perform what is now a regular procedure; namely, primary resection and suture. General acceptance was not accorded the method until the end of the past century. This, in no small degree, was influenced by the introduction of the Murphy button which enabled even the inexperienced surgeon to perform intestinal anastomosis quickly and safely.

Lesions of the colon but rarely lead to nutritional disturbances such as gangrene of strangulation, torsion, or invagination. Resection here is undertaken principally for chronic lesions, chief among which is carcinoma. More rarely one encounters tumor forming tuberculosis, etc. For this reason colon resection is in reality treatment of colon cancer in a broader sense.

But even in these chronic conditions, our standpoint regarding the one-stage operation is a conservative one. Several factors influence this viewpoint:

1. Suture of the large intestine is more hazardous than that of the small intestine because of its anatomical peculiarities, its thin walls, its haustra, its epiploic appendices, and its adjacent omentum.

2. The large intestine is more vulnerable than the small intestine because of its tendency to distend and to react unfavorably to the injurious influence caused by long cessation of peristalsis. (Operative trauma.)

3. The fluid or semifluid intestinal content, such as one always finds in an obstructed colon, is particularly infectious.

4. The short-circuiting of the large intestine, on the other hand, has no effect upon the patient's nutrition, so that an artificial anus high up in the colon does not lead to inanition.

The technique and the prognosis of the operation vary materially depending upon whether the cæcum, the ascending colon, or the left colon is resected. It is technically easier to resect the right colon if the terminal portion of the ileum is included. For this reason it deserves a separate description.

## 1. RESECTION OF THE RIGHT COLON (RESECTIO ILEOCOLICA)

A pararectal incision or one parallel to Poupart's ligament may be employed. When mesenteric glands are involved a long incision is necessary. The extent of resection is suggested on the one hand by the location of the growth, on the other by the anastomosis to be performed. Colon to colon anastomosis is more difficult than ileocolic anastomosis; the joining of the ileum to the ascending colon is usually more difficult and less reliable than that of the ileum with the movable transverse colon. It is our custom to include the terminal ileum, as well as to carry the excision up to the transverse colon in lesions confined to the cæcum. In a few cases, however, in which anatomical conditions were favorable, the ileum was joined to the ascending colon.

We have also implanted the ileum into the freely movable transverse colon and closed blindly a large conserved part of the ascending colon. The long blind sac in this location generally is not productive of any symptoms in my experience. In only one case, operated on by myself in Innsbruck years ago, did the blind sac give rise to symptoms which subsided only after its removal.

It is my preference to carry the resection up to the transverse colon while performing an ileocolectomy for a lesion limited to the cæcum. This procedure enables us to remove a considerable amount of the mesentery with its lymph glands.

In carcinoma of the cæcum we usually think of the ileocæcal mesentery as the seat of the involved glands. There are individuals, however, in whom the ileocolic artery is absent, and the entire right colon, including the cæcum, is nourished by the right colic artery. In such cases the lymph glands draining the cæcum are to be found in the area of

[1]Translated by Dr. George Halperin

the ascending mesocolon. It is clear that in this type of case extending the resection up to the transverse colon is more satisfactory from the standpoint of radical treatment of cancer.

*Technique.* We begin the operation with mobilization of the cæcum. A longitudinal incision is made into the parietal peritoneum alongside the lateral aspect of the cæcum and the posterior surface of the latter is separated from the posterior abdominal wall by blunt dissection. If any glands are encountered they are removed along with the bowel. Here we must look out for the ureter. Mobilization is carried to the limit of the proposed resection. A gauze compress is laid in the cavity created by the separation of the bowel from the posterior wall, the cæcum is laid back in its bed, and the mesentery is divided.

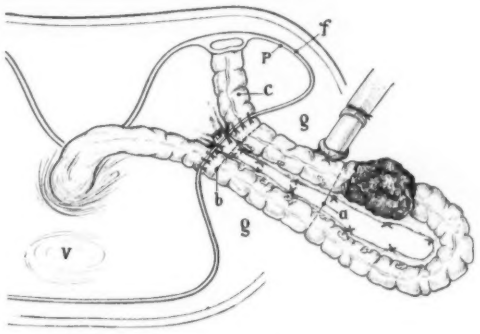
It happens occasionally that in an effort to dissect out the glands so much mesentery is sacrificed that the nourishment of the small intestine is compromised necessitating a far more extensive resection than was originally intended. For this reason we only exceptionally commence with resection of the small intestine.

In the next step the ileum is divided between clamps. The cut ends of the bowel are protected with moist compresses and are laid aside. The large intestine is divided in the same manner at the level of the mesenteric division. Its cut end is sometimes tied off with a ligature and the latter turned into the lumen of the colon as a short stump by means of two or more purse-string sutures.

In order to support the first suture sufficiently, we add one or two rows more of protecting sutures and finish the procedure by fixing the mesentery or the epiploic appendices over them. We emphasize especially the use of a large piece of the colon in this procedure as we thus gain a longer ventlet and greater security.

Nevertheless we must clearly emphasize the rule to do the rejoining suture only after the blind pouch has been made. Otherwise we have always to feel the possibility of prolapse of the ventlet into the anastomosis, which might produce occlusional disturbances. Later we are also enabled in that way to correct the length of the ventlet accordingly. By promptly paying heed to the conditions mentioned, we never have had to contend with an insufficiency or a laceration of the blind end of the colon; and have never had to extend it before the abdominal wall.

An end-to-end or a side-to-side anastomosis in the isoperistaltic direction is performed. The suture line should be placed in the tænia libera. This textbook rule, however, cannot be always adhered to. It is frequently desirable to bring broad peritoneal surfaces together, in which case the tænia libera is too narrow to accommodate both the anterior and the posterior suture lines. Two suture lines of silk are employed whether the end-to-side or the side-to-side method is used. The sutures of the inner row penetrate all the layers; the outer serous sutures are also deep but do not enter the lumen of the bowel. The end-to-side anastomosis is accomplished by means of interrupted sutures; in side-to-side anastomosis a running suture may be used. The mucous membrane on the anterior side is sutured after the method of Schmieden, invaginating the margin well and simplifying the serous suture to follow. The upper and lower angles of the suture line are strengthened by a few interrupted stitches. When convenient, a piece of the mesentery is tacked on. When the omentum is in the way of the suture line, it may be removed step by step, and the resulting bleeding controlled by the next stitch. If, however, one can be sure of reaching with the needle the proper depth of the bowel wall in spite of the intruding omentum, one may leave it undisturbed.




Schematic presentation of the deep reflexion of the parietal peritoneum. When the bowel is delivered without it the resection must follow line *a*. Stripping of the peritoneum makes it possible to resect at the line *b*. *v*, Urinary bladder; *c*, colon descendens; *p*, peritoneum parietale; *f*, fascia transversalis; the cavities at *g* are covered with gauze.

All resulting peritoneal defects must be carefully repaired, preferably by the suture of its margins or by the use of the mesentery. If neither method is available we must drain in spite of the possibility of a future hernia.

Otherwise the peritoneal cavity is completely closed. We consider it, however, a measure of foresight in every case of colon suture to introduce a slender cigarette drain down to the field of the suture line. When the mesentery is

resected in the presence of enlarged inflammatory glands, we must provide drainage for such an area as well, because these can give rise to peritoneal infection. The drain never rests upon the suture line itself; a special small opening is sometimes made for the drain, and then the main incision completely closed. The drain is removed 5 to 7 days later. It apparently does not retard the convalescence. We have not resorted to any other than the one-stage method for the resection of the cæcum in a number of years.

### 11. RESECTION OF THE COLON IN A STRICTER SENSE (TRANSVERSE COLON AND THE LEFT COLON)

The one-stage operation can hardly be considered a regular procedure for the resection of the large intestine. The idea of carrying out colonic resection in several stages, conceived by Heineke and developed by Mikulicz, constitutes one of the most important advances in this field of surgery. The many-stage operation reduced the mortality of the one-stage method from one-third or one-half of all the cases to 25 or 20 per cent, or even lower. However, the increasing sense of security on the part of the surgeon in the matter of colon suture and the desire to shorten the time of treatment, impels many to have recourse in suitable cases to the one-stage method.

We are in accord with those who reserve the one-stage method for cases free from obstructive symptoms, especially from meteorism. Individuals suffering from ileus are not equal to major procedures; and the operation itself is far more difficult than when the bowel is empty. The distended bowel is difficult to suture and the retained fæcal contents in obstructive cases are particularly infectious. The one-stage operation is likewise not suitable for cases in which the growth is located so that the suture has to be performed at a considerable depth in the abdomen. An empty bowel lends itself much better to such a procedure. These are the reasons why we have used since 1911 the one-stage operation in only two-fifths of all our resections of the large intestine.

*A. One-stage resection.* This follows in the main the steps of the one-stage ileocæcal resection. The segment to be removed is mobilized partly through division of the mesentery, partly through separation of the bowel from the posterior abdominal wall. In order to approximate the two segments for the purpose of anastomosis, the adjacent bowel has to be mobilized. Resulting peritoneal defects are repaired by suturing the margins. The resection of the gut follows. Each end is secured between a pair of Doyen or Nussbaum clamps and divided between them with a Paquelin cautery or a knife. The bowels are thoroughly cleansed before operation since it is an advantage not to be bothered by fæcal masses. It is especially advisable when they are fluid or semifluid to stroke the contents carefully away before applying the clamps. Fæcal matter appearing after the application of clamps must be carefully wiped away without soiling the peritoneum. Hard scybalous masses are rather innocuous and may be picked out with forceps.

We have of late favored the end-to-end method of anastomosis provided the free borders were well nourished, otherwise we closed the ends blindly and carried out side-to-side anastomosis.

For the end-to-end anastomosis, only interrupted sutures were used. Two rows of them were employed. The first grasps all of the layers, the second is a Lembert suture, care being taken not to enter the lumen of the bowel. We consider a continuous suture in an end-to-end anastomosis as faulty. With postoperative distention due to hard fæcal matter interrupted sutures will yield, whereas a continuous one will not. A very exact intestinal suture is not necessary. To accomplish it one must remove mesenteric flaps and fatty appendices, or include these in the suture in such a way as not to miss the proper depth of the bowel wall.

In the performing of a side-to-side anastomosis the principle concerning the use of tænia libera holds just as true as in doing an ileocolostomy. There can be no objection here to the use of a continuous suture because one is not limited in the matter of the size of the anastomosis. The slit in the mesocolon is sewed up, raw surfaces are peritonized, a cigarette drain is introduced, and the abdomen is closed.

We favor the use of castor oil after a primary suture as advised by Pendl and have entirely discontinued the use of saline cathartics. These flush the bowel well, but have little influence upon the peristalsis. Their effect is irregular.

The risk in a one-stage operation is not great if the bowel segment is freely movable and the lumina are of approximately the same size. Under less favorable circumstances, we prefer to operate in two or three stages.

*B. The two-stage method.* The two-stage method was developed by Mikulicz. The piece of bowel to be resected is delivered out of the peritoneal cavity, and is resected several days later. The resulting artificial anus is closed at a later date. The method is applicable for the resection of any part of the large intestine, except the lower end of the sigmoid flexure. The movable portion of the sigmoid flexure and the transverse

colon can be operated on that way even in the presence of moderate distention.

The method is applicable only when enough of the bowel can be delivered. This point requires especial emphasis. There is a considerable danger in the two-stage operation, especially when the cancerous bowel is more or less fixed, of not being able to deliver enough of the bowel, as well as the danger of leaving behind the involved lymph glands. The delivery of a sufficiently large piece of bowel may be aided by mobilization of the bowel, or by "deep reflexion"[1] of the parietal peritoneum, or by the combination of the two. Mobilization is accomplished by freeing the adhesions to the neighboring organs, or to the abdominal wall, and by transverse division of the mesentery. In the first step the serosa of the mesocolon is incised as far away from the growth and the involved glands as is possible; the vessels of the mesentery are ligated and cut.

If these measures do not suffice, the mobilization can be extended to the adjoining gut. All bare surfaces must be peritonized and the tear in the mesentery sutured. The afferent and efferent limbs of the gut are placed one next to the other, and both are sutured to the parietal peritoneum. The operation is completed by the closure of the abdominal wall. The possibility of the eviscerated gut proving to be impassable, is forestalled by tying a tube into the afferent limb oralward from the tumor, as advised by Hochenegg. The eviscerated gut will become partially necrotic and will be amputated a few days later.

Another method of which we make use consists in the primary amputation of the isolated gut, ligating the efferent limb, and tying a glass tube into the afferent limb.

A very reliable maneuver in delivering a sufficiently large segment of intestine consists in stripping down the parietal peritoneum. This is performed in the following manner: The parietal peritoneum is grasped together with the transversalis fascia at the margin of the abdominal incision, and is reflected inward as far as possible. At the deepest point of its reflection it is sutured to both limbs and to the mesentery of the eviscerated gut (see illustration). This reflexion can be carried out well enough over Poupart's ligament and over the iliac crest because there the divided internal oblique and transversalis muscles are easily retracted inward. The stripping down of the peritoneum is somewhat more difficult in the median line because the recti muscles do not allow great retraction. By the use of this method, one may gain 5 to 6 centimeters for each limb in the evisceration of the sigmoid flexure with carcinoma, or of its continuation into the descending colon. This frequently makes the mobilization of the adjoining gut unnecessary.

A narrow strip of iodoform gauze is placed upon the suture line which unites the peritoneum to the bowel. It is just above this line that the bowel is divided at a later date. This place is indicated by leaving some extra sutures. The musculature is sutured so as not to constrict unduly the space where the bowel is to be divided later. Dressings are laid upon the wound. Four or five days later they are removed and the bowel is divided just above and flush with the strips of iodoform gauze.

The closure of the artificial anus is undertaken after the wound has granulated. In cases in which the gut was sutured to the peritoneum under tension, or in which the peritoneal reflexion was practical, one must wait for some time because otherwise the anastomosis itself will be carried out under a certain amount of tension. In consequence of the remarkable tendency on the part of the large intestine to stretch, two and a half or three months will suffice. At the end of this time the great gap can be bridged and the anastomosis finished without much difficulty. This deep fixation of the peritoneum permits of a very radical resection with a better chance for a cure even though it does entail the carrying for months of an artificial anus.

Great caution must be exercised even after months of waiting, while freeing the ends of the gut preliminary to the anastomosis; otherwise we risk tears of the bowel on the adhesions to the parietal peritoneum and are forced to sacrifice a valuable piece of bowel from one or the other limb. An end-to-end anastomosis is performed, two rows of interrupted sutures being employed.

*C. Three-stage resection.* The three-stage procedure, developed by Schloffer, consists in first making an artificial anus above the obstruction, in the cæcum or in the transverse colon. In the second act the resection and the anastomosis are performed on a bowel free from fæcal content, and in the third act the artificial anus is closed. The method is particularly applicable in cases complicated by ileus, in which nothing more than an artificial anus could be attempted as the first step in any event. It is also applicable in cases not complicated by ileus, but in which the suturing has to be done at a considerable depth, as, for example, in the case of cancer in the lower segment of the sigmoid.

It is also occasionally indicated in cases in which the growth involves easily accessible seg-

[1] Schloffer. Zur zweiseitigen Dickdarmresection; Tieflegung des Peritoneum. Zentralbl. f. Chir., 1926.

ments of the gut, but in which, in consequence of a high grade ileus, localization of the obstruction is impossible.

We are influenced in the selection of the site of the artificial anus by two considerations. The first is to place the anus as far as possible from the site of the future laparotomy. The second consideration is not to place it too far from the seat of obstruction for fear that it will not function properly and in exceptional cases lead to perforation of the obstructed gut. For growths of the sigmoid flexure and the transverse colon, the anus is frequently made in the cæcum. Because of its length and mobility the transverse colon can be easily reached by a right side pararectal incision. A right-sided anus is an advantage in operating upon the left colon.

An intestinal fistula is not a satisfactory substitute for an anus, because it is essential that the bowel to be resected be kept free from fæces. We prefer a colostomy after Maydl. This insures a permanent spur. The method consists in passing a strong hard rubber tube underneath the loop of the gut through a hole in the mesentery. The deep layers of the abdominal wall, including the peritoneum, are sutured underneath the tube; both limbs of the bowel are sutured to the parietal peritoneum. Next the muscles are sutured, and a tube is placed into the summit of the eviscerated gut. The rubber tube slips out after a few days and the opening in the gut is then widened with the cautery. The hard rubber tube which the bowel straddles insures the persistence of the spur until the healing of the later intestinal suture (15 days after the second operation), and insures the passage of the fæces into the eviscerated loop.

We allow at least 3 weeks to elapse between the establishment of the artificial anus (first act) and the resection and anastomosis (second act). The bowel between the artificial anus and the diseased portion has to be irrigated during this period. This, however, is discontinued in the last few days, because the presence of the irrigating fluid in the bowel during the operation may prove harmful, whereas the presence of a few hard fæcal lumps is of no consequence.

The technique of the resection and suture is the same as that described for the one-stage operation. Should the suture prove difficult, as in the case of the lower portion of the sigmoid, one need not be as particular as in the one-stage operation, provided a sufficient overlapping of the serosa is accomplished. The requirements placed upon the suture here are not as great as in the case of the one-stage operation because the bowel is kept for weeks after operation at rest and free from fæcal contents.

The closure of the artificial anus is undertaken as soon as the suture line is healed and the patency of the anastomosis is demonstrated (X-ray, passage of fluids, cabbage, potatoes, etc.).

The advantage of the three-stage method, in spite of its duration, consuming in some cases not less than 2 months, is to be seen in its greater safety as applied to the more difficult cases. The question always arises in cases of death after the first operation of the two-stage method whether the patients could not have been saved by recourse to the three-stage method. We are compelled to admit the same possibility in the fatalities following the one-stage operation. In spite of these considerations the tendency is toward the two-stage rather than the three-stage operation, and in the same way we have a preference for the one-stage operation when it is not definitely contra-indicated by the existing conditions.

The individual surgeon will resort to the one-stage or the many-stage operation depending upon the material at his disposal. An enlightened community will furnish early cases not complicated by obstructive symptoms. In such localities the surgeon will have a high percentage of one-stage operations, whereas the surgeon who has to deal with neglected cases characterized by ileus or marked distention will do more multiple operations.

# NEWER DEVELOPMENTS OF ELECTROTHERMIC METHODS IN THE TREATMENT OF NEOPLASMS

By GEORGE A. WYETH, M.D., New York

THE applicability of electrothermic methods to the eradication of accessible neoplastic growths, and of those which may be made accessible, is beginning generally to be admitted. The profession's natural and proper reluctance to accept a new procedure in the treatment of these conditions is disappearing as the benefits of the electrothermic method are repeatedly demonstrated.

It is the purpose of this paper to set forth the newer developments of high frequency currents and to show what more recent applications have accomplished in the removal of neoplastic growths, but we would first direct attention to the few old truths which seem often to need restatement. One is that no neoplastic growth is of negligible importance.

Because the basal-cell epithelioma is not so malignant as the squamous or prickle-cell, does not metastasize so early, and is more or less amenable to a variety of treatments, it does not follow that the profession can afford to adopt any casual procedure for its early removal. The writer recalls the dictum of a former professor to the effect that basal-cell epitheliomata could be flicked off with the finger nail, but experience has too often shown that inconclusively treated these neoplasms are capable of causing widespread destruction and even death itself. It is important that in their early stages these lesions should not be subjected to treatment by physical measures, the effect of which is to lock up the malignant cells in fibrotic tissue. The malignancy should be destroyed and removed. We present herewith a case in which the monopolar, dehydrating current proved a very wise substitute for the scalpel.

Case 1. Mrs. H. S. (referred by Dr. F. Brennan of Brooklyn), age 59, was operated upon March 10, 1925. The accompanying illustration shows a lesion of 8 years' growth. The rate of growth had been very greatly accelerated within the preceding month and the sensitiveness greatly increased. Clinical diagnosis was melanoma but no slide was made because the black proliferations on an old pigmented nævus indicated a situation serious enough to make us wish to destroy the whole without exposing the patient to the danger of mechanical dissemination by the taking of any tissue for microscopical examination. Complete anæsthesia was employed in order to avoid the traumatism of a novocain needle near the growth. With the standard technique of monopolar endothermy the lesion was removed in a single treatment and the result was in the highest degree satisfactory. There was none of the scarring which would have followed an operation by scalpel surgery, none of the fibrosis and telangiectasis which would have followed the repeated treatments by physical measures. There has been no recurrence to date.

Another old truth that always needs restating is that precancerous conditions, warts, moles, nævi, pigmented areas, keratoses, angiomata, etc., so located as to be subject to pressure or to repeated injury are likely to suffer a malignant degeneration and should be destroyed and removed. Their removal can the more earnestly be recommended since it can now be accomplished by the employment of the lighter dehydrating current, without the certainty of scarring by scalpel and without danger of mechanical dissemination of malignant cells in the event that the benign lesion has already become active.

Although more and better work is being done today than ever before in the use of the two currents which have been the object of study and observation over a period of many years, it is through the development and perfection of the endotherm knife (7) that high frequency is of still greater usefulness in surgery.

As produced by the three-element vacuum tube system, the true cutting current (a current of exceedingly high frequency) causes a molecular dissolution of the tissues. With the ordinary steel needle which is the usual active electrode and which needs to be only lightly brought into contact with the skin, a clean-cut incision is made with a narrow line of coagulation on either side. This narrow line of coagulation is sufficient to seal off lymphatics as it cuts, and to cap sensory nerves. The incision permits of primary union with a superior cosmetic result.

By sealing lymphatics we tend to limit the danger of metastasis and the likelihood of mechanical dissemination, it now being generally accepted that malignant cells do not pass directly into the capillaries but are carried by the phagocytes into the lymphatics. In an article which appeared in *Minnesota Medicine* in January, 1925, W. J. Mayo pointed out that only particles of molecular size such as the amino acids, sugar, and other crystalloids are absorbed directly through the vascular capillaries of the body,

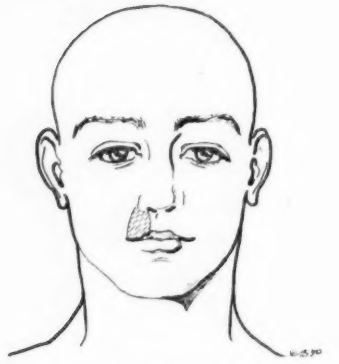


Fig. 1. Case 1. Complete removal and healing with no constricture and no telangiectasis.

while colloids and large particles are picked up by the lymphatics. Hence the danger of transplantation which lies in the scalpel's severance of lymphatics from a malignant area, and the advantage to the operator and the patient inhering in the employment of the endotherm knife which seals these channels as it cuts.

By capping the ends of the sensory nerves we tend to protect our patient against surgical shock, a concomitant of scalpel surgery of such serious importance that Crile (1) has found it worth while to devise his anoci-association operation to block the causative afferent impulses.

These advantages are secured to the patient incidentally to the incision if the operator properly uses the endotherm knife. The following case is reported in detail to show the technique of employing the endotherm knife.

Case 2. The patient, R. A., a child of 5 years, on the service of Dr. A. Benson Cannon at the City Hospital, had at birth a black mark as large as a quarter on the back of her head. No attention was paid to it until it began to grow. Radium treatment was instituted and continued for over a year. Surgical interference having been refused by several leading New York hospitals on account of glandular involvement, the growth's removal by endothermy was determined upon. At this time the case was as illustrated in Figures 3 and 4.

With the patient under complete anæsthesia the lesion, a fibro-angiosarcoma, which was soft and nodular to the touch and did not appear to be fixed to the bony structure of the cranium, was excised on June 27, 1925, by the endotherm knife. The mass was removed as a whole, with practically no hæmorrhage, *and no surgical shock*. In Figure 4 a considerable cervical glandular enlargement may be noted. Undermining the skin downward from the lower edge of the incision we employed bipolar endothermy to coagulate these enlargements which were left *in situ*. They have since become absorbed. Convalescence, though slow, was satisfactory. The wound filled in and healed over and new hair began to grow in from the edges. The patient has gained many pounds in weight and is now attending school regularly. We know of no other method or combination of methods which could have accomplished this result. Attempts to check the growth of the malignancy by tissue conversion following the use of physical measures had failed; the scalpel was clearly contra-indicated; old electrothermic methods would have been of no avail. With the endotherm knife the operation was brief, clean, practically bloodless, and effective.

The endotherm knife is valuable not alone in removing such exceptional conditions as this fibro-angiosarcoma. It is very effective in the treatment of malignancy of the breast, whether a benign or malignant tumor is to be excised or a radical amputation is to be performed. In the former case a fine incision is made over the tumor, the growth is gently elevated and the cutting current excises it without opening lymphatics.

There is no manipulation, no mechanical dissemination of malignant cells. Miscroscopic diagnosis can be had without danger to the patient. In the performance of a radical breast removal by the endotherm knife, any standard technique can be followed. Throughout the process the cut is a sterilizing one; the severance of capillary blood vessels is accompanied by sealing off; the time needed is amazingly reduced; the sealing of lymphatics has guarded against implantation; the capping of severed nerve endings by the very thin line of coagulation which characterizes the incision with the endotherm knife has provided against shock.

In discussing radical breast operation with the endotherm knife and without ligatures, Kelly (3) considers it unlikely that the Halstead-Willy Meyer technique will be notably improved, but he welcomes changes which tend to shorten the length of the operation and decrease the handling of the wound. He says: "We believe we have such an improvement in the radical breast operation in the new endothermic methods." He continues: "After removing the breast and the axillary glands *en masse*, with or without the pectoral muscles, a complete hæmostasis is secured by a rapid and new method described by Ward in *The Medical Journal and Record* for April 15, 1925. The clamps left on the bleeding vessels are lifted one by one in the operator's left hand and held at right angles to the patient's body, while the right applies the active needle electrode switched over to the coagulating (damped high frequency) current momentarily to each clamp. The current flows down and off the point, striking the vessel held in its jaws. The measure of the duration and amount of current applied is a slight hair-like ring of coagulation at the point of the clamp. We have recently done a number of radical breast

Fig. 2. Case 1. Mrs. H. S. Old pigmented nævus which had become active, with deep black proliferations.

operations as well as excised various suspicious looking nodules, using electrothermic methods alone, securing primary union in all but one, a simple amputation in a fat patient. In the radical procedures, the axillary and infraclavicular tissues were also completely dissected out with the endotherm knife; in some the large pectoral muscle was denuded of its investing fascia and left skeletonized."

In May, 1925, A. C. Scott (5) submitted a report of 65 breast cases treated by the galvanocautery or electric cautery, which was remarkable for the record of 70 per cent living and well after 3 years, and 11 cases of whom 72.8 per cent were living and well after 5 years. These results, unapproached by any we have seen submitted

Fig. 3 (left). Case 2. R. A., 5 years of age, with fibro-angiosarcoma of scalp excised by the endotherm knife.
Fig. 4. Case 2. Showing enlarged glands of neck.

Fig. 5 (left). Case 2. Lesion healed after excision by the endotherm knife.
Fig. 6. Case 2. Showing absence of enlarged glands of neck.

Fig. 7. Case 2. Gross specimen of fibro-angiosarcoma.

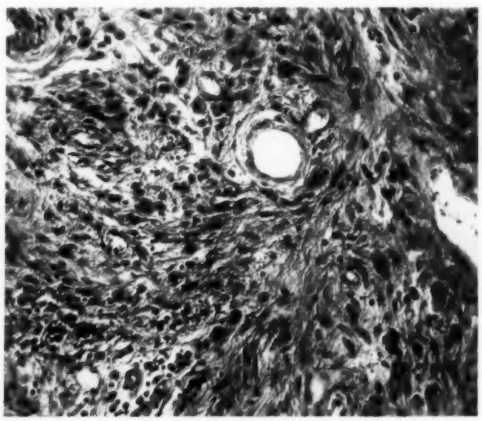


Fig. 8. Case 2. Photomicrograph of fibro-angiosarcoma.

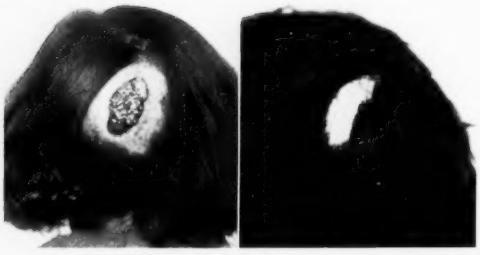


Fig. 9 (left). Case 3. M. M. Cerebelliform melanoma of scalp. Excised without hæmorrhage, under local anæsthesia, by the endotherm knife. The wound was immediately sutured and healed by primary union.

Fig. 10. Case 3. Soft, pliable healing. No recurrence of metastasis in almost 3 years.

elsewhere, are obtained by using a hot flat-wire electrode, the cautery knife. In endothermy the applicator is always cold when applied. We congratulate Dr. Scott highly on these achievements and admit that we find in his accomplishment great encouragement for an ever wider extension of the usefulness of endothermy. By the endotherm knife in breast removals we are working on the same fundamental principles, sterilizing, sealing, and protecting, with the difference that in endothermy we have more perfect control of depth and extent of destruction, and the further difference that by the endotherm knife a line of incision is secured, the edges of which will permit of a quicker and more perfect union.

Herewith are shown photographs of a case of large cerebelliform melanoma of the scalp in the removal of which the effectiveness of the endotherm knife was demonstrated. Probably no other lesion is so baleful in its portent as the melanoma. Its record for immediate recurrence and widespread dissemination after surgical interference has made the surgeon pause.

Case 3. (Cornell Clinic 47799.) M.M., age 25, with cerebelliform melanoma of scalp, reported that the lesion was growing; therefore its immediate removal was advised. The cutting current of the endotherm was employed in March, 1924, and within a very few minutes, under local anæsthesia, the entire growth was excised, without hæmorrhage. The wound was sutured and healing was by first intention. The smooth scar which resulted from this so brief operation will be noted. There has been no evidence of recurrence or of dissemination over a period of almost 3 years.

In further illustration of our claim that the endotherm knife provides a means of widely extending the limits of surgery's usefulness in eradicating accessible malignancy, we present the following case, which will, we believe, be found interesting from a pathological as well as from a surgical point of view.

Fig. 11. Case 3. Photomicrograph of melanoma showing widespread distribution of melanin granules.

Case 4. A. G., a Pole, age 58, was admitted to the Third Surgical Division of Bellevue Hospital, March 4, 1924. At the request of Dr. George D. Stewart the writer removed the growth by endothermy on March 13.

The patient's family history was good. She was somewhat emaciated and pale but was able to walk about the ward. According to her report, the growth had begun some 3 years before as a sore inside the cheek, opposite the right bicuspid. Her teeth began to hurt her and she consulted a dentist who said she had a crooked tooth which might be the cause of the trouble. This tooth was drawn but the sore did not heal. It remained small for a year and then it began to grow. During the 6 months preceding her arrival at Bellevue it had grown very rapidly and at the time I saw her the mass was the size of an extremely large orange. There was no pain nor tenderness but at intervals the tissue would bleed and parts of it would fall away. It involved the right cheek and upper lip, mainly to the right of the midline. The skin was tense and shiny and there were three spots of ulceration. Dilated veins were seen at the upper and lateral aspects of the mass. Externally the growth extended from 4 centimeters anterior to the angle of the mandible on the right side around to the point opposite to the first incisor tooth on the left side. Interiorly it extended from the last molar to the midline and there was seen a deep crater-form ulceration which extended to the upper lip. The mass was lobulated and tense. Freely movable, it raised the right ala of the nostril and seemed to involve the tissues of the upper lip and cheek only. There were a few palpable lymph glands on both sides of the neck, more on the right.

With the patient under ether narcosis, the growth was isolated from the surrounding healthy tissue by a path of coagulation necrosis, at its base only, by the technique of bipolar endothermy (8). Lymphatics, blood vessels and sensory nerves having been thus seared off, the endotherm knife was brought into use. This current of exceedingly high frequency, operating through the same needle which had executed the coagulation wall, quickly excised the tumor without hæmorrhage. A clean wound was exposed to which vaseline dressing was applied. Convalescence was rapid, there being, as usual, no secondary

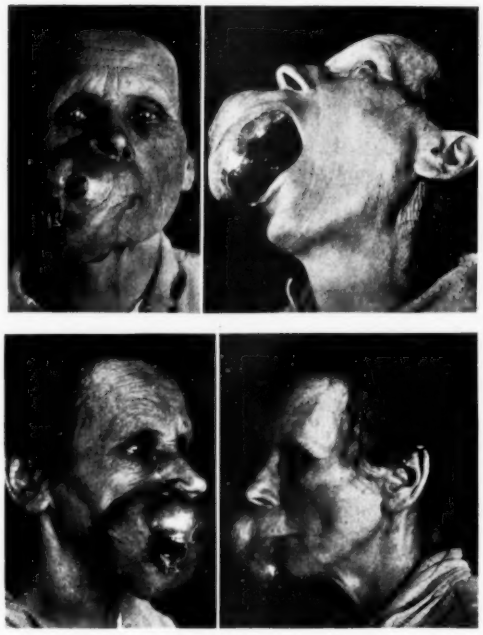


Fig. 12. Case 4. A. G. Large, malignant tumor of cheek and lip. Removed without hæmorrhage by the combined technique of bipolar endothermy and the endotherm knife. Four views.

reaction and no evidence of surgical shock. The patient was able to take food well, the wound sloughed without interference and granulation and filling in of the excised tissue took place. There was no secondary hæmorrhage and the wound healed in 4 weeks. One month later plastic operation was performed by Dr. Arthur M. Wright of the same hospital service.

*Pathologist's report.* Clinical diagnosis. Tumor of lip. March 15, 1924. Microscopic examination shows the presence of a malignant new growth, the histology of which is slightly suggestive of adamantinoma and were the tumor located in the bone I should have no hesitancy in making a positive diagnosis of adamantinoma. The fact that the tumor was removed from the soft tissue in the vicinity of the lip, however, renders this diagnosis highly problematical, although one cannot entirely overlook the possibility of an adamantinoma of the soft tissues springing from congenitally misplaced enameloblasts. On the other hand, I have seen many striking examples of changes in morphology occurring in metastatic growths, in which the secondary growth bore no resemblance whatsoever to the parent growth and it is quite possible that the tumor in this particular patient represents a metastatic growth which has so changed its morphology as to resemble an adamantinoma.

The diagnosis of spindle-cell sarcoma must also be taken into consideration, although close inspection of the cells leaves me under the impression that they are epithelial and that the tumor belongs in the group of epitheliomata. There are so many possibilities to be taken into consideration that a positive diagnosis, in my opinion at least, is not justified. (Signed) Douglas Symmers, Director of Laboratories.

Fig. 13 (left). Case 4. One month after operation.
Fig. 14. Case 4. After plastic operation. No recurrence in almost 3 years.

The fact that endothermy has proved so dependable in the removal of exceptional lesions which appeared to be entirely beyond the reach of all other known remedial agencies encourages one to believe that it will continue to offer, in all cases of accessible malignancy, a definite extension of surgery. Every report of cancer statistics, with its large proportion of inoperable cases, indicates that an extension of present methods is needed to reach a larger precentage of those who present themselves for treatment.

Thus, Simmons of Boston (6) reporting in 1925 a series of 103 cases of cancer of the tongue seen at the Collis P. Huntington Memorial Hospital from 1918 to 1920, says that 76 were inoperable and that in only 19 of the remaining 27 cases (only 18.4 per cent of the whole) was some form of surgical operation performed.

Similarly Judd and New (2) reporting in 1923 their results in 303 cases of carcinoma of the tongue seen at the Mayo Clinic in the years from January, 1910, to January, 1923, tell us that 185 cases (61.05 per cent) were judged inoperable. If our most skillful and most resourceful surgery still leaves untouched so large a percentage of the cancer sufferers, must we not as surgeons seek out a new method, or a modification of an old method, which shall bring help to a greater number of cancer sufferers?

As a statement of the applicability of physical measures to these mouth conditions we have the Radium Report issued by Douglas Quick, of the Memorial Hospital (4) for 1923, which covers 148 cases of cancer of the tongue observed

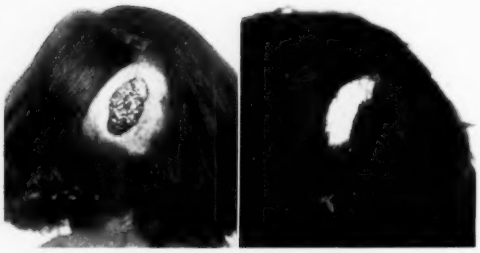


Fig. 9 (left). Case 3. M. M. Cerebelliform melanoma of scalp. Excised without hæmorrhage, under local anæsthesia by the endotherm knife. The wound was immediately sutured and healed by primary union.

Fig. 10. Case 3. Soft, pliable healing. No recurrence of metastasis in almost 3 years.

elsewhere, are obtained by using a hot flat-wire electrode, the cautery knife. In endothermy the applicator is always cold when applied. We congratulate Dr. Scott highly on these achievements and admit that we find in his accomplishment great encouragement for an ever wider extension of the usefulness of endothermy. By the endotherm knife in breast removals we are working on the same fundamental principles, sterilizing, sealing, and protecting, with the difference that in endothermy we have more perfect control of depth and extent of destruction, and the further difference that by the endotherm knife a line of incision is secured, the edges of which will permit of a quicker and more perfect union.

Herewith are shown photographs of a case of large cerebelliform melanoma of the scalp in the removal of which the effectiveness of the endotherm knife was demonstrated. Probably no other lesion is so baleful in its portent as the melanoma. Its record for immediate recurrence and widespread dissemination after surgical interference has made the surgeon pause.

Case 3. (Cornell Clinic 47799.) M.M., age 25, with cerebelliform melanoma of scalp, reported that the lesion was growing; therefore its immediate removal was advised. The cutting current of the endotherm was employed in March, 1924, and within a very few minutes, under local anæsthesia, the entire growth was excised, without hæmorrhage. The wound was sutured and healing was by first intention. The smooth scar which resulted from this so brief operation will be noted. There has been no evidence of recurrence or of dissemination over a period of almost 3 years.

In further illustration of our claim that the endotherm knife provides a means of widely extending the limits of surgery's usefulness in eradicating accessible malignancy, we present the following case, which will, we believe, be found interesting from a pathological as well as from a surgical point of view.

Fig. 11. Case 3. Photomicrograph of melanoma showing widespread distribution of melanin granules.

Case 4. A. G., a Pole, age 58, was admitted to the Third Surgical Division of Bellevue Hospital, March 4, 1924. At the request of Dr. George D. Stewart the writer removed the growth by endothermy on March 13.

The patient's family history was good. She was somewhat emaciated and pale but was able to walk about the ward. According to her report, the growth had begun some 3 years before as a sore inside the cheek, opposite the right bicuspid. Her teeth began to hurt her and she consulted a dentist who said she had a crooked tooth which might be the cause of the trouble. This tooth was drawn but the sore did not heal. It remained small for a year and then it began to grow. During the 6 months preceding her arrival at Bellevue it had grown very rapidly and at the time I saw her the mass was the size of an extremely large orange. There was no pain nor tenderness but at intervals the tissue would bleed and parts of it would fall away. It involved the right cheek and upper lip, mainly to the right of the midline. The skin was tense and shiny and there were three spots of ulceration. Dilated veins were seen at the upper and lateral aspects of the mass. Externally the growth extended from 4 centimeters anterior to the angle of the mandible on the right side around to the point opposite to the first incisor tooth on the left side. Interiorly it extended from the last molar to the midline and there was seen a deep crater-form ulceration which extended to the upper lip. The mass was lobulated and tense. Freely movable, it raised the right ala of the nostril and seemed to involve the tissues of the upper lip and cheek only. There were a few palpable lymph glands on both sides of the neck, more on the right.

With the patient under ether narcosis, the growth was isolated from the surrounding healthy tissue by a path of coagulation necrosis, at its base only, by the technique of bipolar endothermy (8). Lymphatics, blood vessels and sensory nerves having been thus seared off, the endotherm knife was brought into use. This current of exceedingly high frequency, operating through the same needle which had executed the coagulation wall, quickly excised the tumor without hæmorrhage. A clean wound was exposed to which vaseline dressing was applied. Convalescence was rapid, there being, as usual, no secondary

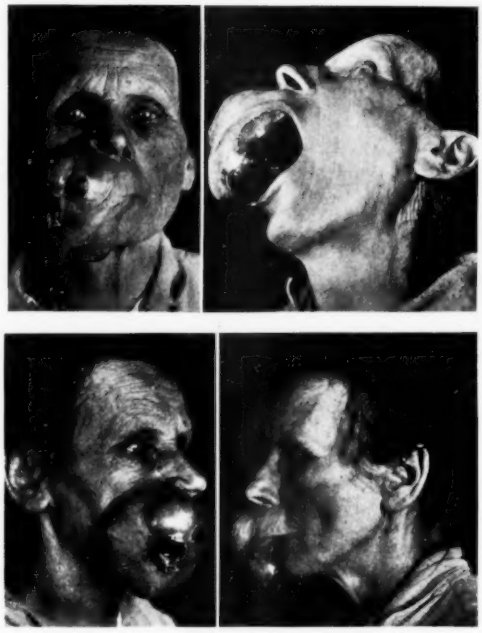


Fig. 12. Case 4. A. G. Large, malignant tumor of cheek and lip. Removed without hæmorrhage by the combined technique of bipolar endothermy and the endotherm knife. Four views.

reaction and no evidence of surgical shock. The patient was able to take food well, the wound sloughed without interference and granulation and filling in of the excised tissue took place. There was no secondary hæmorrhage and the wound healed in 4 weeks. One month later plastic operation was performed by Dr. Arthur M. Wright of the same hospital service.

*Pathologist's report.* Clinical diagnosis. Tumor of lip. March 15, 1924. Microscopic examination shows the presence of a malignant new growth, the histology of which is slightly suggestive of adamantinoma and were the tumor located in the bone I should have no hesitancy in making a positive diagnosis of adamantinoma. The fact that the tumor was removed from the soft tissue in the vicinity of the lip, however, renders this diagnosis highly problematical, although one cannot entirely overlook the possibility of an adamantinoma of the soft tissues springing from congenitally misplaced enameloblasts. On the other hand, I have seen many striking examples of changes in morphology occurring in metastatic growths, in which the secondary growth bore no resemblance whatsoever to the parent growth and it is quite possible that the tumor in this particular patient represents a metastatic growth which has so changed its morphology as to resemble an adamantinoma.

The diagnosis of spindle-cell sarcoma must also be taken into consideration, although close inspection of the cells leaves me under the impression that they are epithelial and that the tumor belongs in the group of epitheliomata. There are so many possibilities to be taken into consideration that a positive diagnosis, in my opinion at least, is not justified. (Signed) Douglas Symmers, Director of Laboratories.

Fig. 13 (left). Case 4. One month after operation.
Fig. 14. Case 4. After plastic operation. No recurrence in almost 3 years.

The fact that endothermy has proved so dependable in the removal of exceptional lesions which appeared to be entirely beyond the reach of all other known remedial agencies encourages one to believe that it will continue to offer, in all cases of accessible malignancy, a definite extension of surgery. Every report of cancer statistics, with its large proportion of inoperable cases, indicates that an extension of present methods is needed to reach a larger precentage of those who present themselves for treatment.

Thus, Simmons of Boston (6) reporting in 1925 a series of 103 cases of cancer of the tongue seen at the Collis P. Huntington Memorial Hospital from 1918 to 1920, says that 76 were inoperable and that in only 19 of the remaining 27 cases (only 18.4 per cent of the whole) was some form of surgical operation performed.

Similarly Judd and New (2) reporting in 1923 their results in 303 cases of carcinoma of the tongue seen at the Mayo Clinic in the years from January, 1910, to January, 1923, tell us that 185 cases (61.05 per cent) were judged inoperable. If our most skillful and most resourceful surgery still leaves untouched so large a percentage of the cancer sufferers, must we not as surgeons seek out a new method, or a modification of an old method, which shall bring help to a greater number of cancer sufferers?

As a statement of the applicability of physical measures to these mouth conditions we have the Radium Report issued by Douglas Quick, of the Memorial Hospital (4) for 1923, which covers 148 cases of cancer of the tongue observed

in the 3½ years preceding the issuance of the report. We are told that although 69 cases were primary growths without glandular involvement only 34 were classed as surgically operable and of the 148 cases only 4 were alive and clinically free from disease 2½ years from the time of beginning treatment.

In the perfection of endothermy and the development of a definite technique in its operation there has been a very great extension of the limits of surgery's effectiveness in the treatment of malignancy, and in no other class of cases is this usefulness more clearly demonstrated than in cases involving the mouth. Naturally these newer methods cannot be described with precision by the employment of old terms and it is therefore in the interest of clarity and definiteness that the writer has suggested the use of the comprehensive term endothermy to mean the surgical application of high frequency currents and the acceptance of the word diathermy to mean their medical application.

The manifest advantages of this extension of surgery in the removal of neoplastic diseases are: the applicability of surgery to a much wider range of cases; the reduction of the danger of metastasis and the likelihood of recurrence; the quickness and ease of the application; the possibility of repeated operations; the absence of surgical shock; and a minimum of hæmorrhage and trauma, with soft, pliable scar.

It will be seen that endothermy is not offered as a substitute for surgery. It gives to the surgeon a means of pushing further the limits of what may be done in behalf of the cancer sufferer and it protects him against many of the untoward concomitants of scalpel surgery in these cases.

## REFERENCES


1. Crile, G. W. J. Am. M. Ass., 1902, February 22, 1912, lix, 114.
2. Judd, E. S., and New, G. R. Carcinoma of the tongue; results obtained at the Mayo clinic. Surg., Gynec. & Obst., 1923, xxxvi, 163.
3. Kelly, H. A., and Ward, G. E. The radical breast operation with the endotherm knife (acusector) and without ligatures. Ann. Surg., 1926, lxxxiii, 42.
4. Memorial Hospital, Radium Report. New York, 1923, 1924, pp. 31 and 48.
5. Scott, A. C. J. Am. M. Ass., 1925, lxxxv, 1447.
6. Simmons, C. C. Cancer of the tongue and mouth. Am. J. Roentgenol., 1925, xiii, 545.
7. Wyeth, G. A. Report presented at the annual meeting of the Medical Society of the State of New York, Rochester, April 23, 1924.
8. Idem. Endothermy in the treatment of accessible neoplastic diseases. Ann. Surg., 1924, lxxix, 9.

# VOLVULUS OF THE SIGMOID FLEXURE

By JOHN B. DEAVER, M.D., F.A.C.S., Philadelphia, and JAMES A. MAGOUN, M.D., Toledo, Ohio

VOLVULUS of the sigmoid, although not a frequent abdominal condition, occurs often enough to enter into consideration in the diagnosis of the acute abdomen. The profession should therefore be familiar with its treatment.

Unlike some of the more common conditions leading to acute abdominal manifestations, the etiology of volvulus is not very definite. It affects the two sexes alike and may occur at any age. In the five cases occurring in the Lankenau Hospital in the past ten years the ages ranged from 20 to 64 years. Three of the patients were males and two females. There were two deaths (both males), making an operative mortality of 40 per cent. It is interesting to note that the oldest patient was a woman aged 64 years who was reported entirely well 36 months after operation.

The main contributing factor to volvulus of the sigmoid is constipation or obstipation. The twisting of the bowel may, however, arise from various causes such as a redundant sigmoid or megasigmoid in which the stagnation of fæces and the formation of hard scybalæ will favor the formation of a volvulus. It may also occur as the result of bands of adhesions developing either before operation or, as in one case in our experience, after operation.

In this instance, the patient, a female, came to operation for a fibroid uterus. A complete hysterectomy was performed and both tubes and one ovary were removed. On the third day after operation she complained of nausea and cramp-like pain in the lower abdomen. The pain was progressive, and shortly after onset an indefinite mass was palpable in the lower abdomen. Operation was indicated and on opening the abdomen, 9 days after the first operation, we found a volvulus of the sigmoid together with several adhesive bands of intestines. After the adhesions were divided the volvulus was untwisted. As the sigmoid did not appear to be enlarged or redundant, nothing further was done, the bowel was replaced and the abdomen closed. The patient, when heard from one year later, had remained perfectly well. The only sequel of the operation was a small incisional hernia.

In the diagnosis of volvulus, a few points may be of significance although the differentiation from other acute abdominal crises is not always possible. First of all, there is usually a history of obstipation, very often associated with attacks of more or less definite abdominal distress. The acute angulation, as a rule, is manifested by severe abdominal pain and all the signs and symptoms of acute intestinal obstruction. The character of the pain is somewhat significant. In addition to the history of previous attacks, which generally yield to treatment of the obstipation by several enemas, the pain is not referred to the umbilical region as in disease of the small bowel and the appendix but is localized in the left lower abdomen and persists in that region, not showing the progressively descending character associated with malignancy. Moreover, the pain is very intense and throws the patient into a state of profound shock. As a rule, a mass or swelling can be made out in the left lower abdomen.

The following case shows one type of syndrome as well as the serious character of the condition:

A man, 25 years old, born in America and a steward by occupation, was admitted to the Lankenau Hospital, March 27, 1917, with the complaint of cramp-like abdominal pain. He had been obstinately constipated for 4 or 5 days. On the day of admission he had a desire to empty his bowels, but was unable to do so. He was then seized with a sudden severe pain in the lower abdomen, intermittent in character. He took castor oil, which he vomited. He vomited three or four times subsequently and belched continuously. An enema was given with a poor result, but the patient felt somewhat better. The pain returned soon after this and continued very severe.

The past medical history revealed marked constipation and the constant use of purgatives. He had had a similar attack of pain several years ago from which he was relieved by abdominal massage and four or five enemas.

The physical examination showed an obese, young, adult male. The abdomen was greatly distended, particularly in the upper portion. It was markedly tympanic throughout and peristalsis was easily visible through the abdominal wall. There was no evidence of hernia. The rectal examination was negative. The pulse was 72 and respiration 24 per minute. The leucocytes were 11,200 with 90 per cent polymorphonuclears. The acute condition indicated immediate operation.

A long right rectus incision was made. The sigmoid was found to be enormously distended and gangrenous. There was complete rotation of the sigmoid and a dark sanguinous fluid filled the peritoneal cavity. The volvulus was untwisted, but on account of the poor condition of the patient nothing further was done. Following the operation the patient went into profound shock and gradually passed away.

The two cases thus far cited illustrate the extremes of the condition. A mean between the two and another type of syndrome is represented by a third case.

A man, 20 years old, and a clerk by occupation, was admitted to the Lankenau Hospital August 30, 1918, with the complaint of "pain in the stomach." Two years ago he had a sudden attack of severe pain in the left side of the abdomen, about 5 centimeters below the umbilicus. There was

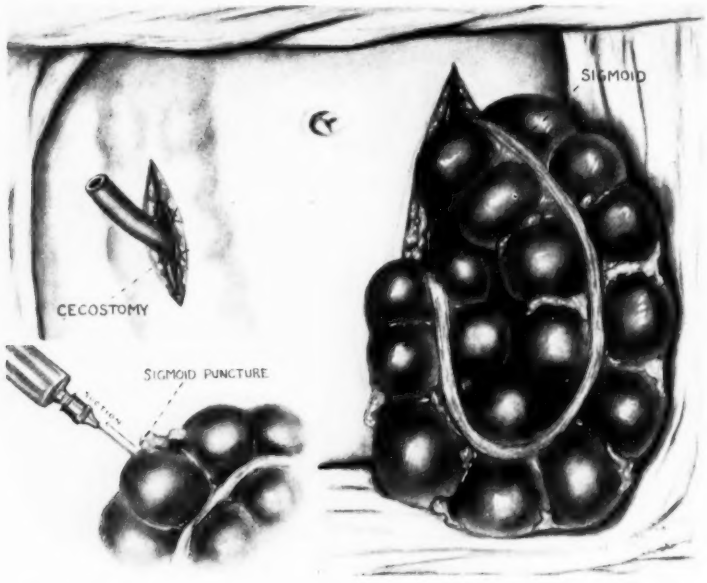



Fig. 1. First stage, Mikulicz operation on the left, cæcostomy on right of patient, sigmoid puncture.

no nausea or vomiting. For the past 2 days he could neither move his bowels nor pass gas. The abdomen became swollen, especially in the left lower quadrant. This attack, like the others, was relieved by repeated enemas. On the day of admission he was seized with a very sharp pain in the left lower abdomen, which persisted as a cramp-like pain and inability to pass flatus.

The physical examination showed the abdomen to be distended and tympanitic. There was slight, generalized tenderness especially marked in the lower left quadrant. Peristalsis could not be seen and no masses could be palpated. The pulse was 72, respiration 20 per minute, and temperature 98 degrees F. The urine showed a trace of albumin, indican, and acetone. The leucocytosis was 7,600 with 64 per cent polymorphonuclears.

Operation was performed through a low right rectus incision. There was a small amount of bloody fluid in the peritoneal cavity. The sigmoid was found to be enormously distended and to be completely twisted on itself. The volvulus was untwisted and a sigmoidosigmoidostomy was performed at the lower end of the loop. A colon tube was passed up the rectum and through the anastomosis into the descending colon. The wound was closed with layer sutures.

After a stormy convalescence, the patient made a complete recovery and was discharged perfectly well. In October, 1918, he reported that he had remained well, without any evidence of recurrence. The patient has not been heard from since.

The three cases illustrate the various procedures which should enter into consideration in the surgery of volvulus.

First of all, the evidence for an acute intestinal obstruction or some other acute abdominal catastrophe is abundant and surgery should be resorted to immediately regardless of the condition of the patient. In dealing with this entity several procedures may be employed: a large right rectus or midline incision should be made, the sigmoid located and if a volvulus is present, whether clockwise or counter-clockwise, it should be untwisted and any adhesive bands freed.

After this formal procedure the operation should be continued according to the exigencies of the case. If the sigmoid seems to be in good condition, an anastomosis may be made at the lower end of each loop, and a colon tube passed up through the anastomosis into the descending colon. This was done with complete success in two of the cases, without any recurrence of the volvulus, which is the one danger of this particular technique. If untoward symptoms should occur at any future time a resection of the loop distal to the anastomosis could easily be performed. Recurrence of the volvulus is possible, however, even without this procedure, as in the case already mentioned of a woman, age 64 years.

A woman, aged 64 years, single, was admitted to the Lankenau Hospital on November 23, 1922, suffering with

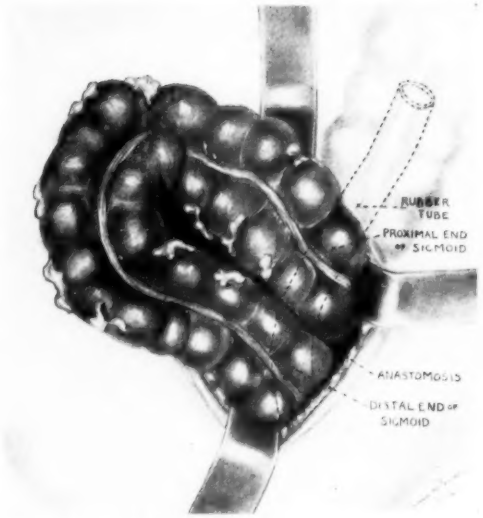



Fig. 2. Volvulus of sigmoid. Anastomosis of sigmoid before resection of diseased portion. Dotted lines indicate rubber tube passing through anastomosis.

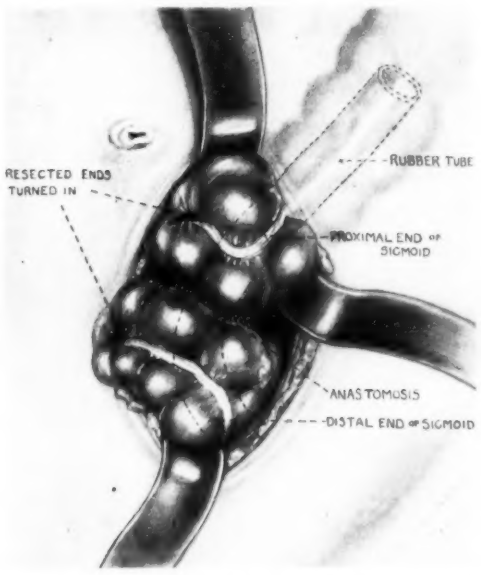



Fig. 3. Volvulus of sigmoid. Completed anastomosis with resected ends of sigmoid turned in. Dotted lines indicate rubber tube passing through anastomosis.

obstipation. Three days before admission she had cramp-like pains in the abdomen associated with vomiting. These pains have continued, and she has had a very small liquid bowel movement daily since the beginning of the attack. The pain seemed to start in the left iliac fossa and radiate over the entire abdomen and into the back. The physical examination showed an adult female evidently very sick. The abdomen was markedly distended. On rectal examination there appeared to be a movable mass on the anterior surface of the rectum.

Operation was performed on November 25, 1922. A lower right rectus incision was made. The sigmoid was found greatly dilated and twisted. The volvulus was untwisted and a few adhesive bands divided. As the bowel seemed patulous, nothing further was done and the wound was closed.

Two weeks later the patient again developed cramp-like abdominal pains. Enemas were returned clear and there was some distention in the left lower abdomen. The abdomen was again opened and a volvulus of the sigmoid found. This was untwisted and an anastomosis between the proximal and distal loops of the sigmoid was made. A colon tube was passed up the rectum through the anastomosis and into the descending colon. The wound was closed. Convalescence was uneventful with the exception of a slight infection in the wound. Five months after operation the patient was complaining of slight constipation. Thirteen months after operation she was entirely free from complaints. Her bowels were regular and her appetite and digestion good. Thirty-six months after operation she was perfectly well.

A one-stage resection performed at the time of the acute obstruction is not always a wise procedure. If resection is desirable, in the favorable cases, the Mikulicz operation, and in addition a cæcostomy will give the best results with the least mortality.

When the volvulus has persisted for some time, the blood supply of the bowel may have become strangulated either partially or completely so, leading to gangrene of the sigmoid. In such circumstances it seems best to bring the entire sigmoid out of the abdominal wound, as in the first stage of the Mikulicz operation and perform a high cæcostomy. It is possible that the passage of a hollow needle, to which suction may be applied, into the portion of the bowel outside of the abdomen, might result in the withdrawal of toxic material. The punctured wound could then be quickly closed with several inverted sutures, as in the following case:

A man, 35 years old, was admitted to the Lankenau Hospital March 28, 1924, complaining of abdominal pain. For the past year and a half the patient has had attacks of vague abdominal distress. During the 12 hours before his admission he had experienced a sense of tightness about his abdomen, but he had been able to move his bowels. A few hours before his admission he was seized with severe cramps across his lower abdomen and he vomited repeatedly. Examination showed a well nourished adult male in great pain and in a state of shock. There was a boardlike rigidity over the entire abdomen. The upper abdomen appeared distended. The rectal examination was negative.

At operation the entire sigmoid was found to be enormously distended and dilated. The sigmoid and a portion

of the colon were twisted twice on the mesocolon, completely cutting off fæcal and blood circulation. About 14 inches of the sigmoid was dark purple in color. The volvulus was untwisted and the dark section of the sigmoid anchored to the edge of the wound and left outside of the abdominal wall. The patient went into profound shock following the operation and died a few hours later.

Since preparing this paper the senior author has operated on another patient suffering with volvulus of the sigmoid.

The patient, a male, aged 49 years, was admitted to the Lankenau Hospital on March 15, 1926. The history was obtained through an interpreter.

The onset of symptoms was about 6 months ago, when the patient developed pain in the epigastrium which persisted more or less constantly, and became aggravated during the past 6 weeks. The pain is associated with puffiness and distention after meals, and the belching of large quantities of gas, which gives some relief. There has been no nausea and no vomiting. The bowels are constipated, and require daily cathartics; there is also alternating diarrhœa and constipation. He has lost 7 pounds in the past month.

Physical examination shows a slight fullness in the left lower quadrant of the abdomen. Tenderness and tympany are present throughout the abdomen, more marked along the course of the sigmoid. There is some slight spasm of the left lower rectus. Peristalsis is accentuated over the descending colon, and is more marked in the left lower abdomen.

Operation was performed March 20, 1926. Through a left lower rectus incision, a redundant, twisted sigmoid was exposed. A sigmoidosigmoidostomy was done, and the appendix incidentally removed. The wound was closed without drainage.

The patient was discharged April 2, 1926, having made a complete and uneventful recovery.

## CONCLUSIONS

These few instances permit of several conclusions which it seems worth while to emphasize. While the diagnosis of volvulus is never absolutely certain, the symptoms nearly always indicate the presence of a serious abdominal lesion, which usually is interpreted as acute intestinal obstruction and demands immediate exploratory laparotomy, for delay may be fatal.

The condition of the patient, unless moribund, should not be an influencing factor; the symptoms are always progressive and rapidly so.

Radical surgery should be avoided if possible. If resection is to be done, the two- or three-stage type of operation associated with an ileostomy or cæcostomy will give the best results.

In the extremely severe cases, we feel that the procedures, as herein described, offer the greatest chance for recovery.

# AN OPERATION FOR RECTOVAGINAL FISTULA COMPLICATED BY A THIRD DEGREE TEAR

By H. LAURAN DARNER, M.D., Jacksonville, Florida
From the Department of Gynecology and Obstetrics, University of Rochester, School of Medicine and Dentistry, Rochester, New York

IN no branch of operative gynecology is the variety of methods so manifold as in the field of its plastic surgery so that I hesitate to present a new method or a variation of one of the present methods for the handling of a lesion such as rectovaginal fistula. So far as the patient is concerned, it is immaterial what method one uses so long as the symptoms are relieved. As in other fields of plastic surgery that method is best which in the hands of the individual surgeon offers the best possible chance of primary union. Anyone who has had the responsibility of caring for patients with rectovaginal lesions will agree that eventual healing is more uncertain than is generally supposed. Certainly, I have seen failures occur when the operation seemed to be admirably done. The cause of the failure is clearly due to a multiplicity of factors most important of which are (1) the inability to prevent soiling of the operative field with fæcal matter which may cause suppuration and interfere with immediate union or result in the complete breaking down of the plastic operation; (2) an abundance of dense cicatricial tissue poorly supplied with blood which inhibits healing and lends itself admirably to becoming infected; (3) faulty approximation of the edges of the fistula; (4) excessive loss of tissue at the original injury which results in the bringing together of the edges of the fistula under considerable tension so that the sutures fail to hold; (5) imperfect hæmostasis with accumulations of blood between the various layers of the repair acting as culture media for the pyogenic organisms which are constantly present in the field of operation. The presence of a third degree tear complicating the rectovaginal fistula in this case made it imperative that these adverse conditions be reduced to the minimum. The technique used in the case reported was comparatively easy to carry out and has given such an excellent result that it was considered worthy of reporting.

E. Q., housewife, married, aged 29, entered the Strong Memorial Hospital, January 19, 1926, complaining of pain in the lower abdomen, rectal tenesmus, incontinence of fæces and leucorrhœa. The family history is negative as regards the present illness. The past history is negative except for the following points. The onset of the catamenia was at 14 years of age. The duration is usually 3 days, flow being normal in amount. There has been no dysmenorrhœa. The interval between periods varies from 4 to 8 weeks. The last period was 7 weeks ago. The patient has been married 6 years. Soon after marriage there was a 3 months' spontaneous abortion which the patient attributes to a fall. Twenty months ago there was a full-term pregnancy which will be discussed more in detail in the present illness. The appendix was removed through a McBurney incision in 1915. She has been subject to urticaria, which is precipitated by various fruits and uncooked vegetables.

*Present illness.* The patient dates the onset of her present illness to the birth of a child 20 months ago. Labor was at full term, child weighing 4,500 grams. The duration of labor was over 30 hours and was finally terminated by forceps. The patient was delivered at home by her local physician and there was no immediate perineal repair. During the puerperium, she noted that the bowels were difficult to control and upon getting out of bed had complete fæcal incontinence which has persisted to the present time. There have been several attacks of colic-like lower abdominal pain, not related to meals and not occurring at any particular time of day except that symptoms are increased by exertion. Two weeks ago, when recovering from a severe cold, the stools became watery for several days and on one occasion they were blood-tinged. Since the onset of the present illness there has been a profuse leucorrhœal discharge which has become much worse in the past month. During the same period there has been some dysuria but no nocturia or frequency.

*Physical examination.* Patient is a poorly nourished and anæmic white woman who appeared ill and in considerable pain. The temperature on admission was 37.5 C. There were three urticarial wheals on the cheeks and abdomen which are associated with the food idiosyncrasies noted above. The general physical examination was negative otherwise except for the abdomen and pelvis. The abdomen is flat and symmetrical, shows a small hair-line McBurney operative scar, numerous lineæ albicantes. The abdominal walls are thin and atonic with marked diastasis of the recti muscles. Moderate tenderness is elicited in both iliac fossæ, more marked on the left side where there is a suggestion of a mass just above the pelvic brim. The sigmoid is palpable at the pelvic brim and tender. The external genitalia are negative. Bartholin's and Skene's glands are negative. There is considerable injection of the vaginal mucous membranes. The end-result of the perineal tear is excellently shown by the artist's sketch (Fig. 1) made at the time of the operation. It can be noted that the perineal body has been almost completely destroyed except for a remnant of tissue extending across the anal orifice anteriorly. The external sphincter ani muscle has been completely torn and retracted. The sphincter dimpling can be easily seen at each lateral border of the anal orifice. The transverse widening and distortion of the anal orifice is quite evident. This bridge of tissue is about 1 centimeter wide and about 5 millimeters thick. Just beyond the upper margin of this remnant of the perineal body there is a rectovaginal fistulous tract. It has an elliptical shape and is about 2 centimeters long by 1.5 centimeters broad. It easily permits the passage of one finger. Along the whole left border of the fistulous tract is an everted papillomatous-

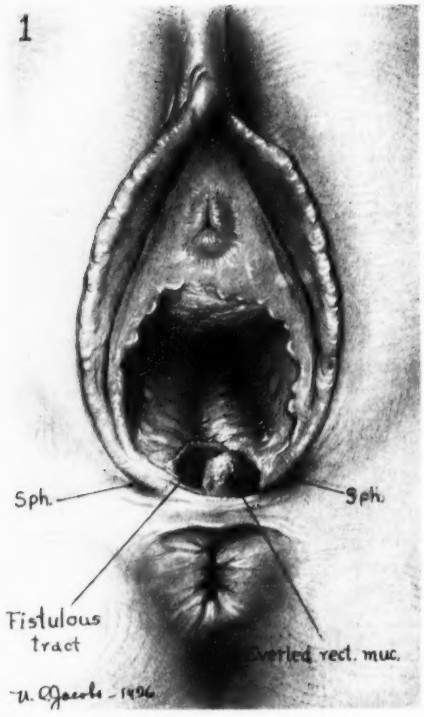



Fig. 1. Sketch of perineal lesion. The narrow perineal remnant with the well defined sphincter pits is clearly depicted. Especially to be noted is the size of the fistulous tract, the papillomatous-like mound of everted rectal mucosa and the scar-tissue band extending up the recto-vaginal septum from the upper edge of the fistula.

like segment of rectal mucosa as shown in the sketch. The entire fistulous tract was surrounded by dense, almost cartilaginous-like, scar tissue. Beginning at the upper margin of the fistulous tract and extending up the recto-vaginal septum in the midline there is a broad band of scar tissue about 3 centimeters long. Above this there is slight bulging of the posterior vaginal vault particularly on straining. There is a small cystocele. The cervix is softened and enlarged. There are deep bilateral lacerations and a profuse mucopurulent cervical discharge. The fundus is forward in normal position, hard, firm, symmetrical but firmly fixed. There is marked œdema and induration in both broad ligament regions. The right adnexa could not be outlined. There was a left tubo-ovarian mass about 8 centimeters in diameter. It is firmly fixed, fluctuant and extremely tender.

Rectal examination adds nothing to that already noted. There is no sphincter action whatever. The anal orifice is tremendously dilated. Pelvic mensuration: There was a typical funnel pelvis. The measurements of the pelvic inlet were normal. The pubic arch was narrowed. The transverse diameter of the outlet was 7.75 centimeters, the anterior sagittal diameter being 5.5 centimeters, the posterior sagittal 8 centimeters. The antero-posterior diameter of the outlet was 11.5 centimeters.

*Laboratory examination.* Hæmoglobin is 69 per cent (Sahli). Leucocyte count 14,400. Blood Wassermann negative. Urine negative.

Clinical diagnosis: salpingitis, bilateral, chronic and subacute. Tubo-ovarian abscess, left. Relaxed vaginal outlet. Third degree laceration of the perineum. Rectovaginal fistula. Rectocele. Secondary spastic colitis. Funnel pelvis.

*Course in hospital.* The acute abdominal manifestations subsided quite satisfactorily under palliative measures so that within a week the broad ligament induration and œdema had almost completely disappeared. The leucocyte count had fallen to 8,000. Symptomatically, the patient was markedly improved. It was evident that the necessary operative procedures would have to be carried out in two stages. In view of the extensive and active pelvic infection, it was considered advisable to take care of this condition first.

The first operation was done January 26, 1926. A midline suprapubic incision was made. The uterus was found to be in normal position. Both adnexa had been replaced by large inflammatory tubo-ovarian abscesses which had gravitated into the cul-de-sac. The upper peritoneal cavity was thoroughly walled off from the operative field as I felt that the adnexal masses would be ruptured in freeing them from the pelvic peritoneum. A considerable amount of greenish-yellow pus did escape during the operation. So completely were the ovaries involved in the inflammatory lesion that a small segment of the right ovary was saved only with considerable difficulty. Two cigarette drains were placed in the cul-de-sac and drawn out through the vagina. The uterus was then suspended by a modified Coffey method and the abdomen closed.

The patient made an uncomplicated recovery. On the eighteenth postoperative day, it was considered perfectly safe to go ahead with the second operation. The hæmaglobin at the time of the second operation was 54 per cent. For several days before operation the patient was kept on a soft diet. The day before operation she was thoroughly purged and given enemata the night before and the morning of operation.

### TECHNIQUE OF OPERATION

I have always felt that the cutting across of the remnant of the perineal body as a primary step in operations on lesions of this type is a rather radical procedure inasmuch as it destroys the one intact structure bridging the defect. In the present case, it served so admirably as an anchorage for the anterior rectal wall that its preservation was of the utmost importance. No matter under how little tension the rectal wall is drawn down, there is bound to be some tension attendant upon the usual postoperative œdema and infection which always occurs in such cases. This may not be sufficient to interfere materially with such an intact bridge of tissue but it may possibly cause separation of the various layers of the repair if a cloaca has been established. In view of the marked mobility of the anterior rectal wall and the fact that there is often a rectocele pouch as in the present case, the rectum as far as the upper mar-

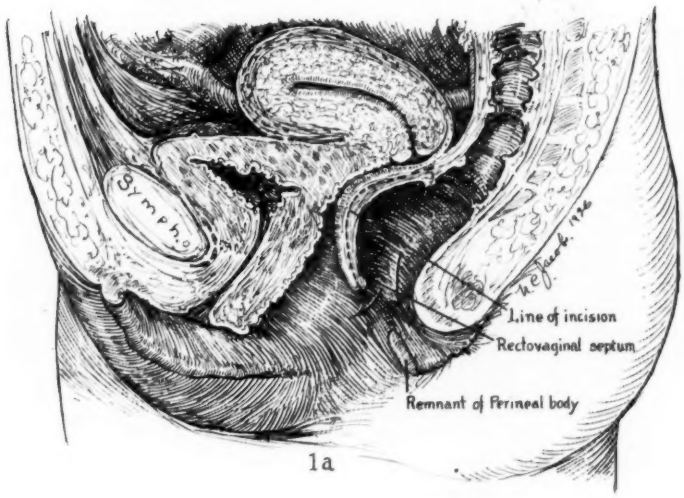



Fig. 1a. Reproduction of lesion, seen in sagittal section. Note the rectocele pouch above the upper margin of the fistulous tract. Line of incision shown by dotted line. This figure shows very clearly how drawing the anterior rectal wall downward will merely obliterate the rectocele pouch and restore the normal contour of the anterior rectal wall.

gin of the fistulous tract can be drawn down without the slightest tension. Reference to Figure 1a will show at a glance that freeing the rectum from the vagina, as shown by the dotted line, and drawing it down to the anal orifice will merely obliterate the rectocele and re-establish the normal contour of the anterior rectal wall.

The patient was placed in the perineal position and the vagina and perineum prepared for operation. Beginning at the lower margin of the carunculæ myrtiformes on each side an incision was made along the mucocutaneous border as far as the level of the sphincter dimpling. It was then carried around the upper border of the fistulous tract, care being taken to incise only the vaginal mucous membranes (Fig. 2). A pair of iridectomy scissors were found of the utmost value in doing the finer dissection about the fistulous tract. By keeping lateral to the midline scar tissue band the lateral vaginal and rectal walls were easily separated by blunt dissection well up into the rectovaginal septum. Along the course of the scar tissue band, the rectum and vagina were so adherent that a definite line of cleavage could not be found and the dissection had to be done very carefully by sharp dissection (Fig. 3). The rectal wall was very thin and quite adherent as far as the upper border of this band beyond which it was freed easily by blunt dissection.

The upper edge of the fistulous tract in the rectum was now freshened by cutting away a few millimeters of the edge. Two Allis clamps were then passed through the anal orifice (Fig. 3) and the upper edge of the fistulous tract in the anterior rectal wall grasped and drawn down to the anal orifice (Fig. 4). This could be done with absolutely no tension. The under surface of the intact perineal bridge was then denuded of mucous membrane and the drawn-down rectal wall sutured to the anterior portion of the anal orifice by means of numerous interrupted sutures of No. 00 chromic catgut (Fig. 5). One should be very careful that the lateral margins of the rectal tube are accurately drawn down and approximated. Failure to pay particular attention to this may result in a little slit-like defect which could very easily cause a recurrence.

The perineum was again cleansed and the posterior colporrhaphy and suture of the sphincter muscles carried out. The ends of the sphincter muscles were easily grasped, drawn across the midline, and sutured with two mattress sutures of fine black silk re-enforced by a single suture of No. 00 chromic catgut (Fig. 6). The levator

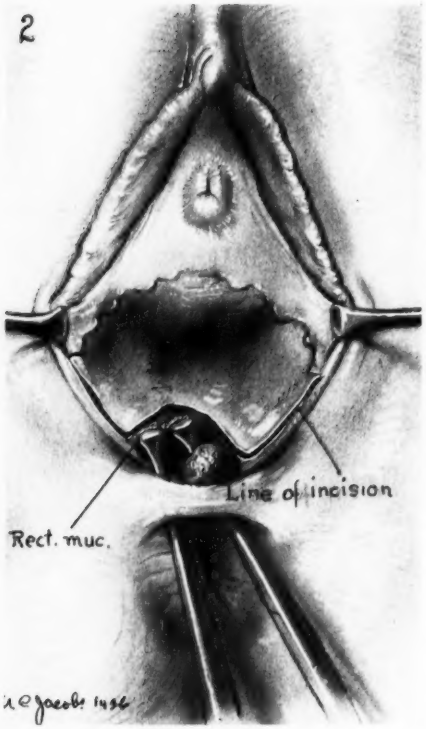



Fig. 2. Same as Figure 1 to show outline of incision. The incision begins at the lower border of the carunculæ myrtiformes on each side, extends downward along the mucocutaneous border to the level of the sphincter pits and then follows the lateral and upper edge of the fistula. Two Allis clamps have been passed through the anal orifice and are attached to the upper edge of the rectal wall bordering the fistulous tract.

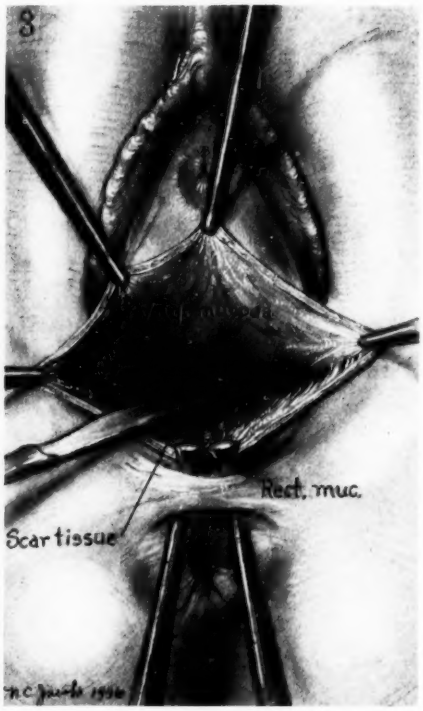



Fig. 3. Second step in the operation. The vaginal wall is gradually being freed from the rectum. Separation at the site of the midline cicatricial band had to be done by sharp dissection as shown in the sketch. Lateral to this band a line of cleavage was easily found and the separation carried out by blunt dissection.

muscles and fascia were then drawn together with three figure-of-eight sutures of No. 3 chromic catgut, each of these sutures being caught in the anterior rectal wall so as to relieve any unnecessary tension on the site of the rectal sutures. The redundant vaginal mucosa which included the vaginal opening of the fistula was then excised and the cut edges, together with the superficial perineal muscles and fascia, drawn together with several continuous sutures of No. 2 plain catgut.

*Convalescence.* Defæcation was prevented during the first 10 days following operation by means of a strict liquid diet and lead and opium pills. The perineal incision, except for a few superficial areas of separation, has healed *per primam.* On the eleventh postoperative day she was given a large retention enema of olive oil. At the same time she was given mineral oil by mouth followed the next morning by a saline cathartic. Twelve hours later, there was a copious semisolid stool. Defæcation caused the patient some discomfort for several days but this gradually disappeared. It is now 10 months since operation and the patient has excellent sphincter control. There is usually one stool per day which is not accompanied by any discomfort. There have been several normal menstrual periods which have not been accompanied by any untoward symptoms. The patient's hæmoglobin upon leaving the hospital was 65 per cent.

## LITERATURE

A thorough review of the literature has failed to reveal a single instance in which an operative procedure as herein described was carried out for the relief of a lesion of this sort. It is not my purpose to discuss or review the entire literature concerning the various methods of handling rectovaginal fistulæ but only that phase of it which

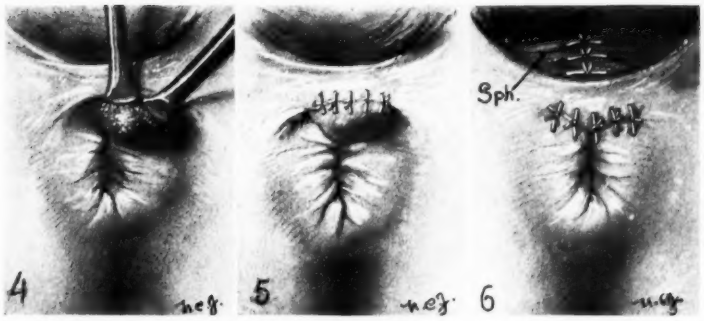



Fig. 4. Upper edge of fistulous tract drawn down to anal orifice. Under surface of the remnant of the perineal body has been denuded of mucosa.

Fig. 5. Anterior rectal wall sutured at anal orifice. Note the transverse distortion of the anterior portion of the anal orifice. The protuberant rectal mucosa shows that there is no tension on the rectal sutures.

Fig. 6. Anal and sphincter sutures introduced and tied. The protuberant rectal mucosa has been replaced. The normal stellate appearance of the anal orifice has been restored.

concerns the attempt to free the rectal tube or its inner layers and draw it down through the sphincter muscles to a point where it can be resected above the fistulous tract and the proximal segment sutured to the rectum near the anal orifice. The numerous methods of cauterization, which are never of any use in such large defects, and the innumerable flapsplitting methods are no doubt familiar to all. For the principle involved in the present case I am indebted to the ingenious operation devised by Whitehead for the resection of an extensive rosette of hæmorrhoids. Whitehead's original communication appeared in 1882. Three years later he reported a series of 300 cases without secondary hæmorrhage, postoperative ulceration, abscess, stricture, or incontinence of fæces. He laid great emphasis upon the fact that the distal rectal incision should be made a few millimeters within the rectal canal through the mucous membranes and not through the skin. He also states that a segment of rectal mucosa 4 inches in length is possible of removal by this method.

Segond, in 1895, was probably the first one to apply Whitehead's idea to the operative treatment of rectovaginal fistulæ. A brief résumé of the history of his case bears repetition.

The patient was a young married woman, aged 31 years. When 15 years of age she and another girl introduced ointment jars into their vaginæ. Nothing was said of the incident as they hoped that the jars would be expelled spontaneously. The other girl soon became ill and died of peritonitis. The patient suffered some discomfort but remained secretive and married 4 years later. She remained comparatively well 10 years but then became ill and for a long time resolutely refused to permit an internal examination. Ultimately she became so much worse that an examination was permitted and the foreign body found solidly embedded in the posterior fornix where a breach had been made in the rectovaginal septum. A local doctor removed the jar with considerable difficulty especially because a mass of granulation tissue had grown into its lumen.

There was constant fæcal incontinence through the fistulous tract so that 8 months later she was referred to Segond. He found a large transverse fistulous tract so high up in the posterior fornix that the upper edge of it was formed by the cervix. He felt that an operation involving the principle devised by Whitehead offered the best chance of success. He made an incision completely around the rectum just through the rectal mucosa and several millimeters above the mucocutaneous border after thorough digital dilatation of the sphincter ani muscles. The mucous membranes once separated from the sphincter muscles by dissection and the sphincter zone passed, he seized the entire rectal wall and using blunt dissection only, separated the entire rectovaginal septum to the level of the fistula. The rectal and vaginal walls about the fistulous tract had to be freed by sharp dissection. The author then claims to have freed the rectum by blunt dissection from the peritoneum in the cul-de-sac without difficulty. He made the important observation that the same method could be more easily applied should the breach be lower down and that the rectum can be excised obliquely since the anterior wall can be freed much more easily than the posterior. His patient made an uneventful recovery.

Dudley and Vineberg report cases in which Segond's operation resulted in the complete relief of the patient's symptoms. Van Noorden reports one case in which a similar operation was performed but the patient continued to have partial incontinence of fæces. Dudley adds the important observation: "In my judgment, in case of high fistula, it would not be necessary to resect the bowel to the level of the fistula but only such por-

Fig. 7. Sketch of perineal incision 3 weeks after operation.

tion of the bowel as would be sufficient to change the position of the rectal opening with that of the vaginal so as to flap each fistulous membrane against unbroken structures and then sewing the parts carefully together with whatever sutures you deem best suited to the occasion." This, it appears to me, is a very important observation especially if there is some contra-indication to approaching such a fistula abdominally and if the freeing and resection of a segment of rectum, including the fistulous tract, by the perineal route is impossible. This seems to be a much more rational suggestion than that of Segond. Most of the more recent writers are inclined to approach high fistula by the abdominal route rather than to attempt the almost impossible procedure of freeing the lower sigmoid from the pelvic peritoneum. Dudley's suggestion, too, will probably be practical in only a few restricted cases.

Von Herff reported an operation much the same as the one herein described.

His patient was 55 years of age. She had had ten children. She had worn a single pessary for 18 years. Two years before operation there was an onset of urinary incontinence. One year later she began to pass fæces *per vaginam*. On examination a fistulous tract three fingers' breadths wide was found connecting the anterior vaginal wall with the base of the bladder and in the posterior vaginal wall at the level of the "sphincter tertius" there was a rectovaginal fistula four fingers' breadths in diameter. The first operation consisted of a flap-splitting operation which promptly broke down. Later a second operation quite similar to the one here recorded was done. The patient died on the fifth postoperative day of bronchopneumonia, so that there was no opportunity to decide whether or not there would have been a successful operative result. The author states, however, that the entire operative field seemed to be healing *per primam*.

Von Herff recommends the method in cases in which other methods have failed and holds the resection of the posterior rectal wall as unnecessary.

Potter describes a somewhat similar operation.

His patient was 26 years of age. The condition was a congenital anomaly. The lesion consisted of a direct connection between the upper portion of the rectum and the middle third of the vagina. There was a rudimentary rectum which connected with the vagina by a second fistulous tract just above the perineal body. This tract was quite separate from that leading to the proximal segment of the rectum from which it was separated by an anomalous wedge-shaped band of tissue posteriorly. The lesion had evidently resulted from the failure of the urogenital fold to grow completely downward and a failure of the lateral folds to fuse in the midline. The first operation consisted of a thorough ether examination and a dilatation of the rudimentary rectum. At a subsequent operation the entire perineal body was split, thus making a common cloaca. The vagina and rectum were separated three-fourths of the way to the cervix. There was a diamond shaped excision of the mound in the posterior rectal wall which was closed longitudinally so as to flatten the mound and lengthen the rectum. The anterior wall was then drawn down and anchored to the levators. The author desiring to permit temporary fæcal incontinence did not suture the sphincter ani muscle. The patient recovered and had partial sphincter control from a bridge of scar tissue joining the ends of the sphincter muscles. She had not returned for a subsequent operation at the time of the publication of Potter's paper.

Except for these few random papers there is nothing further to be found in the literature concerning cases of this sort. Usually in the standard textbooks the entire matter of rectovaginal fistulæ is very sparingly dealt with. They almost invariably suggest cutting across the bridge of tissue and then building up the entire perineal body or roughening the edges of the fistula, freeing it from the adjacent vaginal wall and closing in layers. Abbe, in Keen's *Surgery*, merely mentions freeing the rectal mucous membranes much as Segond did and bringing them down to the level of the upper margin of the fistula.

### ETIOLOGY

The principal etiological factors may be very briefly stated as follows:

1. Direct laceration of the rectovaginal septum during labor, coitus, or other injury such as a fall astride some sharp pointed object.

2. Direct injury at the time of a vaginal or abdominal operation.

3. Spontaneous rupture or erosion of a pelvic abscess, dermoid cyst, hæmatocele or an adenomyoma of the rectovaginal septum.

4. Ulceration of a tuberculous or syphilitic lesion.

5. Necrosis due to a neglected pessary, foreign body introduced into the vagina for auto-erotic purposes or a neglected foreign body in the cul-de-sac following a previous abdominal operation.

6. Ulceration following local radium applications. A detailed discussion of these factors, which are no doubt familiar to all, seems unnecessary.

### CHOICE OF AN OPERATIVE METHOD

Eden has divided rectovaginal fistulæ into three great groups according to their anatomical situation, namely: (1) rectovulvar fistulæ; (2) inferior rectovaginal fistulæ, involving the lower half of the vagina; (3) superior rectovaginal fistulæ, involving the upper half of the vagina.

The third group seldom lend themselves to an operation as here devised. They are much more frequently approached abdominally or by a combined abdominal and perineal operation. Eden suggests doing a preliminary colostomy in selected cases in this situation. The first and second groups can, however, practically always be approached perineally. The small, tortuous, rectovulvar fistulæ occasionally undergo spontaneous closure or close following cauterization with various chemicals, the electric or thermocautery or merely gentle curettage of the fistulous tract. The fistulæ in which there has been considerable loss of tissue never undergo spontaneous healing nor do they respond to such palliative measures. When a small tortuous fistula fails to respond to these measures, the fistulous tract may be dissected out and treated much the same as an appendix stump or the tract may be completely inverted as suggested by David. In the larger fistulæ, some more extensive plastic operative procedure is usually necessary. The edges of the fistula may be freshened, the vaginal and rectal walls freed for a short distance about the fistulous tract and then closed in layers. A more elaborate flap-splitting or denudation method may be necessary. The failures in many of these cases I attribute to the fact that within a wide radius of the fistulous tract, there is a tremendous amount of scar tissue poorly supplied with blood and of inferior vitality. Old operative scars are usually immediately excised in the interests of primary union of an incision in a second operation elsewhere in the body where the operative field is to be approached at the site of a former operation and there is no reason why the same principles should not be considered in perineal operations. In cases in which other operative methods have failed, the cicatricial tissue can not fail to be tremendously increased and it is for this reason that the present operation should be of tremendous value in such cases. The frequent presence of a rectocele above the fistulous tract in multiparous patients is another very important factor in deciding upon this method of operation. It also tends to make it applicable to larger defects and those situated high in the rectovaginal septum. In the present case there was a wide area of scar tissue about the fistulous opening and a broad band extending several centimeters up the rectovaginal septum in the midline. Any effort to have removed the scar tissue would have resulted in such an extensive resection of the anterior rectal wall as to make it impossible to bring the edges of the normal tissue together. The added factor of infection usually inhibits primary union and also accounts for the greater frequency with which such lesions heal *per primam* if they are repaired at the time of the original injury.

### CONCLUSIONS

The operative procedure which I have described is not particularly difficult nor complicated. Because of the great mobility of the anterior rectal wall and the ease with which it is freed from the vaginal wall the operation even in nulliparous patients lends itself admirably to the treatment of rectovaginal fistulæ in the lower half of the vagina. In multiparous patients there is often a rectocele pouch as in the present case or the mobility of these structures is increased so that higher and more extensive fistulæ can be thus handled. The operation has the further advantage that the blood supply of the drawn-down rectal tube has not been interfered with so that the danger of infection is proportionately decreased. A very important point is the retention of the remnant of the perineal body which acts as an anchorage for the anterior rectal wall. If healing fails to take place *per primam* it is hardly conceivable that more than the posterior colporrhaphy would break down. The band of scar tissue would undoubtedly remain intact and hold the rectal wall in position. If this band of tissue is cut and a cloaca established, as advocated by many authors, and then closed layer upon layer, a secondary infection would not stop short of a complete breaking down of all layers and a re-establishment of the cloaca. It is my impression that in subsequent fistulæ complicated by a third degree tear it may be much better to do a two stage operation, at the first operation merely freeing the rectal wall and suturing it to the band

of scar tissue as shown in Figure 5 and doing the plication of the sphincter ani muscles and the posterior colporrhaphy at a later date when it can be done under much more favorable aseptic conditions. In the presence of a third degree tear the operation suggested by Segond is too extensive and almost impossible to carry out without permanently impairing the function of the sphincter muscles. The various flap-splitting operations are certainly of value in certain cases if the injury is comparatively recent or if it is not associated with an excessive amount of scar tissue or a large fistulous tract. The method will be found of great value in cases in which one or more attempts with other operative methods have failed, because in these cases not only are the conditions highly unfavorable to healing but there is a tremendous increase in cicatricial tissue formation. If there is an extensive amount of scar tissue or a large fistula in the lower half of the vagina I certainly feel that in the types of lesions enumerated above, the present operation offers the best possible chance of success.

In conclusion I wish to thank Mr. N. C. Jacobs for his most excellent illustrations of the lesions and the operative steps.

## BIBLIOGRAPHY

1. Abbe, Robert. Keen's Surgery. Philadelphia: W. B. Saunders Co., 1920, iv, 128.
2. David, V. C. Surgical Clin., Chicago, 1919, iii, 1439.
3. Dudley, A. Palmer. J. Am. M. Ass., 1902, xxxix, 185.
4. Potter, C. A. Surg., Gynec. & Obst., 1917, xxv, 110.
5. Segond, M. Paul. Bull. et mém. Soc. de chir., 1890, xvi, 708.
6. Idem. Ann. de gynéc. et d'obst., 1895, xliv, 1.
7. Van Noorden. Aertzl. Rundschau, 1895, Sept.
8. Vineberg, H. N. Med. Rec., 1902, lxi, 895.
9. Herff, Otto von. Zentralbl. f. Gynæk, 1907, xxxi, 429.
10. Whitehead, W. Brit. M. J., 1882, i, 148.
11. Ibid. 1885, i, 449.

# CARDIOLYSIS FOR MEDIASTINOPERICARDITIS

## With Case Report[1]

By JAMES A. MATTISON, A.B., M.D., F.A.C.S., Sawtelle, California
Chief Surgeon, Hospital, National Soldiers' Home

BRAUER (2) in 1902 suggested cardiolysis as a surgical therapeutic measure for the relief of adherent pericarditis complicated by intrapericardiothoracic adhesions. He reasoned that the in-pull of the chest wall during the systole of the heart, which with its pericardium, was bound by adhesions to the intrathoracic parietes, brought about a damaging degree of extra labor on the heart muscle. Brauer (3) suggested the excising of the osteocartilaginous portion of the chest wall over the adherent area of the pericardium, thereby, removing an unyielding bony wall, leaving in its stead a soft elastic wall which would adapt itself readily to the cardiac movements, which would further allow the heart to recede back into the thoracic cavity and relax any other adhesions which might be present, laterally or posteriorly.

Bourne (1) in a review of the literature in 1924 collected twenty-three cases in which this operation had been performed. To this list he added two cases of his own. Of these 25 cases Bourne stated that only 5 operations had been performed in the United States. Marvin and Harvey (9) added another case report in 1924. They referred to 10 cases reported by Treupel (17), Soyesima (12), von Jagic (19), Thorburn (16), Dunant and Turettini (4), two thesis cases by Ensgraber and Schwarzenauer (6), and three reported by von Beck (18) which were not included in Bourne's series.

The case reports in this country included in Bourne's paper were by Dunn and Summers (5), Summers (13 and 14), Hirschelder (7), and Smith (11). To this list should be added in addition the two reported by Marvin and Harvey, and one reported by Loe (8), a total of 7 cases reported in this country.

Summers writes: "Cardiolysis has found no favor in America. Why this is so is incomprehensible to me because the operation is based upon good mechanical principles, is not difficult of execution, neither has it a high mortality. The danger of the procedure is so inconsiderable in proportion to the good to be expected that every physician should familiarize himself with the diagnosis of the condition and every surgeon should learn the technique."

In reference to diagnosis, a carefully taken history will throw much light on the condition. A history of previous attacks of arthritis complicated by pericarditis, with a later history of cardiac embarrassment, and heart failure will be noted in many of these cases. The evidences of heart failure become definitely manifest when the patient is exercising, but subside when quite in bed. A ventricular hypertrophy which cannot be explained by an aortic regurgitation, a raised tension or other reasons is suggestive of an adherent pericardium.

Periapical systolic recession, Broadbent's sign, inspiratory filling of the neck veins, fixation of the apex beat, dyastolic shock and pulsus paradoxus, are other signs and symptoms of diagnostic importance. X-ray, fluoroscopic, and electrocardiographic findings are valuable aids.

### CASE REPORT

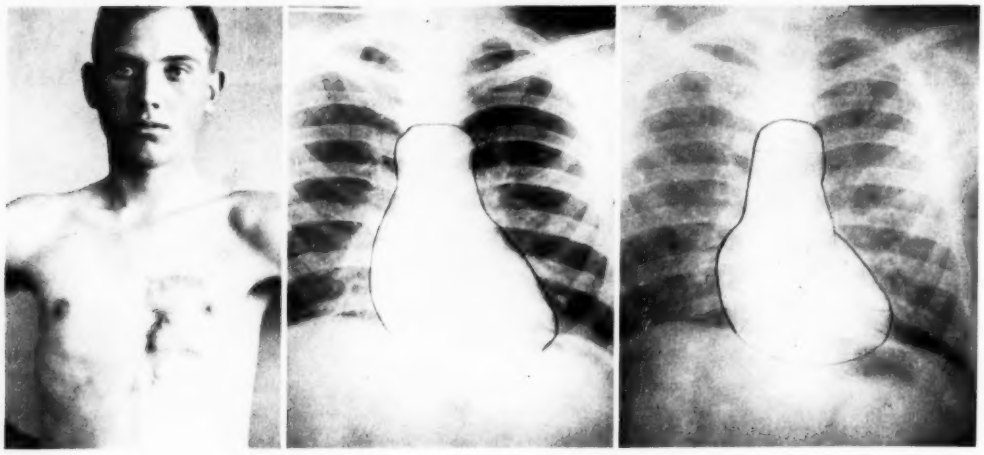
R. B., No. 7061, an American, male, age 22, was admitted to this hospital June 29, 1925, complaining of "constant pain in the left chest, frequent attacks of intense, dragging pain intermittent with heart beats, dyspnœa on slight exertion, and palpitation." These symptoms dated back to October, 1923, and had increased in severity. Patient had been confined to bed most of the time for two and one-half years before admission to this clinic.

There was a history of rheumatism coming on about the age of ten followed by other similar attacks at intervals. He enlisted in the army in September, 1922. The following history was obtained from the Adjutant General's office:—"Treated from January 8, to June 19, 1923, for (1) scarlet fever, (2) acute arthritis of rheumatoid type involving all extremity joints. Complications: February 9, lobar pneumonia, both lobes of left lung, type undetermined; February 12, acute nephritis, following scarlet fever; February 19, chronic fibrinous pericarditis following scarlet fever and arthritis; February 21, pericardial puncture for effusion; February 26, pericardiotomy. From October 19, 1923, to January 5, 1924, he was treated for pericarditis. Discharged on Surgeon's certificate of disability on account of thoracic adhesions, January 5, 1923. He has been unable to do any work since."

The mother died at 40 of pulmonary tuberculosis. One uncle died of pulmonary tuberculosis. One sister had a "nervous breakdown."

Physical examination: Patient is a fairly well developed and nourished, slightly anæmic man, height 67 inches, weight 142 pounds. (Normal weight 159). Dyspnœa is slight while patient lies quiet. He is unable to sleep without sedatives. The teeth are repaired; one central (left) dead and abscessed. Tonsils were removed in 1908. Submaxillary and cervical adenopathy is not marked. The

[1] From the Department of Internal Medicine and Surgery, Hospital, National Soldiers' Home, California.



Photograph of patient and roentgenograms before and after operation.

posterior pharyngeal wall is hyperæmic and granular. Thyroid fullness plus two. There is a marked heaving impulse of left chest with each systole, and a definite retraction at the apex. Cardiac dullness is present from the left anterior axillary line to beyond the right border of the sternum. Pulse rate is 100. Respirations are shallow. Broadbent's sign is visible on left but not on back. Moderate tenderness is present over the lower right quadrant of the abdomen. No tumor masses are palpable. No free fluid is shown in the abdomen. The liver and spleen are not perceptibly enlarged. Examination of the urine shows specific gravity, 1030; slight trace of albumin, otherwise negative.

The blood findings are negative. X-ray examination shows transverse diameter of the heart 16 centimeters. Silhouette area about 136 square centimeters. Cardiodiaphragmatic tug is not observed by means of fluoroscopy. Density of the posterior mediastinal space is increased.

Clinical diagnosis: mediastinopericarditis. Cardiolysis recommended.

*Operation.* The operation of cardiolysis was performed October 10, 1925, under nitrous oxide anæsthesia.

A U-shaped incision was made with the base over the left border of the sternum, the upper arm of the incision extending along the upper border of the fourth rib to the anterior axillary line; the lower arm along the lower border of the sixth rib. The incision was made down to the intercostal muscles and the flap including skin, fascia and muscle reflected outward and upward. Subperiosteal resection of the fourth, fifth, and sixth ribs including the cartilages, left from the anterior axillary line to the sternum was done. The anterior layer of the periosteum was removed to prevent reformation of ribs. The completion of the resection resulted in the retraction of the parietal pleura and pericardium about 2 centimeters and a marked rebound of these structures followed with each heart beat. The wound was closed in layers with plain catgut and the skin closed with dermol.

His condition when he left the operating room was good although the heart action became quite weak and irregular twice during the operation.

He experienced immediate relief from the precordial pain and dyspnœa, and his marked nervousness was improved within the first 2 or 3 days.

The symptoms very rapidly cleared up, the dyspnœa even on exertion has almost entirely disappeared. He sleeps well and has a good appetite, present weight one hundred and fifty-nine, and although he has not yet returned to work, he is able to take long walks and considerable exercise without discomfort.

The author wishes to acknowledge his indebtedness to Dr. John W. Shuman, visiting consultant in the medical service, to Dr. Leonard E. Croft, Dr. R. C. Shawhan, roentgenologist, and to Dr. Hardy Lynch for valuable aid in the observation of the case.

## BIBLIOGRAPHY

1. Bourne, G. The operation of cardiolysis. Quart. J. Med., 1924, xvii, 179.
2. Brauer, L. Ueber chronische adhesive Mediastino-Pericarditis und deren Behandlung. Muenchen. med. Wchnschr., 1902, xlix, 1072.
3. Idem. Die Kardiolysis und ihre Indicationen. Arch. f. Chir., 1903, lxxi, 258.
4. Dunant, R., and Turettini, G. Operative treatment of adhesive pericarditis. Schweiz. med. Wchnschr., 1923, liii, 606.
5. Dunn, A. D., and Summers, J. E. Observations on a case of mediastino-pericarditis treated by cardiolysis. Am. J. M. Sc., 1913, cxlv, 74.
6. Ensgraber and Schwarzenauer. Cited by Lecéne, P. Arch. d. mal. du coeur, 1909, ii, 673.
7. Hirschfelder. Diseases of the Heart and Aorta. Philadelphia: J. B. Lippincott Co., 3d ed., p. 618.
8. Loe, A. O. Cardiolysis for adherent pericardium. Northwest Med., 1925, June, p. 285.
9. Marvin, H. M., and Harvey, S. C. The surgical treatment of adherent pericardium. J. Am. M. Ass., 1924, May 10, p. 1507.
10. Poynton and Trotter. A case of cardiolysis. Proc. Roy. Soc. Med., London, 1909-10, iii, Chirurgical Sect. 199.

11. SMITH, E. S. Cardiolysis for chronic mediastino-pericarditis. M. Clin. N. Am., 1920, Nov. p. 835.
12. SOYESIMA. Deutsche Ztschr. f. Chir., 1909, xcviii, 390.
13. SUMMERS, J. E. Cardiolysis. Surg., Gynec. & Obst., 1917, xxv, 92.
14. Idem. Am. J. Surg., 1913, xxvii, 230.
15. SUTHERLAND, G. A case of cardiolysis for adherent pericardium. Proc. Roy. Soc. Med., London, 1910–1911, Med. Sec., pp. 40 to 50.
16. THORBURN, W. Cardiolysis in heart disease. Brit. M. J., 1910, Jan. 1, p. 10.
17. TREUPEL, G. Bemerkungen zur Diagnose, Prognose, und Therapie der Herzkrankheiten. Muenchen. med. Wchschr., 1905, lii, 1.
18. VON BECK, B. Zur Cardiolysis bei chronischer adhaesiver Mediastino-Pericarditis postpleuritica. Arch. f. Chir., 1904, lxxiii, 958.
19. VON JAGIC. Wien. klin. Wchnschr., 1903, xxii, 1579.

# FRACTURE OF THE TIBIA AND FIBULA

BY CHARLES E. FARR, M.D., F.A.C.S., NEW YORK

THE management of fractures of both bones of the leg is at times a very difficult matter. Some of these fractures need no reduction whatever, and can be put in a splint or plaster cast until union has occurred. Others can be reduced by manipulation under an anæsthetic and can be held in position by simple splints.

In certain cases skeletal traction by tongs, by a band over the os calcis, or by a pin through the os calcis may be employed. There are inherent dangers in each of these procedures which must be carefully weighed. Necrosis and infection are the two most important. Inability to control the fragments properly may invalidate any form of skeletal traction.

Open reduction with plating or bone graft of the tibia must be resorted to in certain types of cases. This is a major operation requiring the utmost in technique, in skill and in judgment. The outcome is not always of the best, and there is a decided element of danger.

In selected cases of fracture of the tibia and fibula, notably when the tibia is badly comminuted or compounded, and especially when infection has set in, it is possible to operate upon the fibula alone. This operation is easy, simple, practical, safe, and gives fairly good results in situations that would be otherwise extremely difficult to handle.

The indications for operation on the fibula, rather than the tibia, are that the fibula is not comminuted, and the overlying tissues have not been too badly damaged by the original trauma, or by operative or manipulative procedure. Fractures near the ankle or the knee are not so suitable as those in the mid shaft.

CASE 1. A longshoreman, 40 years of age, suffered a severe compound fracture of the fibia and simple fracture of the fibula. Various attempts at reduction and holding by extension strips and plaster casts, and simple splints were ineffectual. The tibia wounds were extensive. The tissues were sloughing and even fair position could not be obtained. It seemed unwise to use skeletal traction. Under an anæsthetic a very simple operation on the fibula, which was fractured transversely and showed an inch of overriding, resulted in end-to-end approximation. No internal splint was required. The tibia of this man was fairly well reduced, both bones united within a reasonable time, and the result was a quite good leg.

No operative procedure on the tibia could have been considered. Skeletal traction would have been inefficient and dangerous with the amount of infection in the leg. A very simple operation on the fibula gave an excellent result.

CASE 2. A lawyer, 55 years of age, fell from a height causing a severe comminuted fracture of the tibia and a simple transverse fracture of the fibula in the lower third. He was operated upon by another surgeon who made an extensive incision over the tibia and endeavored to reduce the fragments. This was unsuccessful, or at least the reduction was not maintained. Examination showed very severe comminution of the lower third of the tibia opening into the ankle joint and marked overriding. The wound, although clean, was discharging joint serum at the end of 3 weeks. The fibula was overriding approximately 1 inch, and showed a clean transverse fracture. The man's general health was not good. Further open operation on the tibia was too dangerous because of the joint seepage, and would probably be ineffectual because of the comminuted condition. Skeletal traction seemed unwise because of the condition of the tissues, and the age and disability of the patient. Open reduction of the fibula was carried out in a very few minutes without difficulty, and resulted in completely overcoming the shortening, but did not quite bring into position the tibial fragments at the ankle joint. This was corrected later by another surgeon, and the man now has practically perfect function, with no shortening and no deformity.

CASE 3. L. C., 7 years of age, entered St. Mary's Free Hospital for Children, No. 6993, July 11, and was discharged September 14, 1925. There was a compound fracture of the right tibia and fibula, with considerable laceration of the soft parts and comminution of the tibia. It was impossible to control the position of the fragments in any way except by skeletal traction which seemed unwise, or by open reduction of the tibia, which also was unwise, if it could be avoided. It was therefore decided to operate on the fibula.

Fig. 1. Anteroposterior and lateral roentgenograms before and after operation, Case 3.

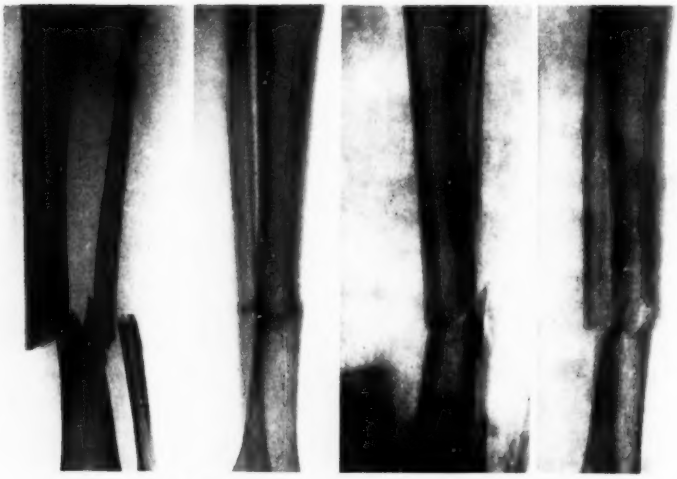


Fig. 2. Anteroposterior and lateral views before and after operation, Case 4.

A ten minute operation reduced the fibula with great exactness, and gave a very fair result in the tibia. The lacerated wound healed without infection. The fragments of the tibia united with the shaft, and the result was an excellent one.

In this case a fair result could have been obtained without operation and in the long run he might have overcome the shortening and deformity as so many children do. Many cases which have been under observation at St. Mary's without operation have eventually done quite well, but one can never be sure of the result. This is a very simple operation and should therefore be applicable in a fairly large percentage of cases; it is not contra-indicated even in a child.

CASE 4.[1] F. B., 21 years of age, entered New York Hospital, No. 265710, service of Dr. Gibson, on February 27, 1926, and was discharged March 18, 1926. She was suffering from a compound fracture of the left tibia and a simple fracture of the left fibula, with marked overriding and lateral displacement of the fragments. Under ether anæsthesia the tibial wound was debrided but no attempt was made to reduce the fragments. On the fibula side an incision 2 inches long was carried down to the fracture in the fibula. By traction and manipulation, the fibula fragments were approximated end to end. It was noted there was some comminution, but sufficient bone was left to hold the position. On examination of the tibia, it was then found that reduction was perfect although no manipulation directed toward that end had been carried out. The incision was sutured and molded plaster splints were applied. X-rays at the end of 14 days showed beginning union in almost perfect position. The wounds healed by primary union and recovery was uneventful.

[1] Case 4 has since been treated by the method outlined.

# LIVING TENDON SUTURE IN APPENDICEAL TECHNIQUE

BY A. MERRILL MILLER, M.D., F.A.C.S., DANVILLE, ILLINOIS
From the Surgical Department of Lake View Hospital

IT is to that resourceful and ingenious master surgeon, L. L. McArthur, that we are indebted for the suggestion and first practical application of the autoplastic tendon sutures in surgical work. That this valuable contribution to technique should remain so long without universal adoption seems to be a definite loss, since the type of operation to which it is applicable stands high numerically on the operative list.

The more recently trained surgeons have often not been made acquainted with this procedure, while the older ones have been satisfied with fixed habits of practice and have not proved its worth. The very limited use of this technique is due, no doubt, largely to lack of information.

The fate of the autotendon in the healing process has been well established by McArthur in his final report (1), and needs no further discussion or evidence. That the tendon accommodates itself to its new position in the human subject and becomes fixed has been proved. Therefore, if by its adoption we can avoid the use of foreign sutures so near the skin in an area of scanty blood supply, its merit must appeal to the critical surgical technician.

While the early reports deal especially with the repair of hernia and its use continued for a quarter of a century with perfect satisfaction, the living autoplastic tendon suture is quite as applicable in the *gridiron incision for appendicitis*. Indeed, the tensile strength of fibers here is probably greater than it is near the rings where all the fibers do not run parallel and may have been thinned by the patient's wearing a truss. At this time, I am not familiar with articles urging its adoption in this connection.

I have used the method in closing the aponeurosis of the external oblique in which case a single strand of attached living tendon one-fourth inch wide was used. The closure of the internal oblique could be accomplished as readily by means of a second strip taken from the opposite side of the aponeurosis.

After subcutaneous fat and areolar tissue is removed, the method of procedure consists in splitting a strip of the aponeurosis one-fourth inch wide from the upper (inner) free edge, without severing its attachment at the upper end where muscle fibers furnish a better blood supply. Because of the muscle, there is considerable "give" to the suture. The tendon having been carefully split from below upward to the muscle belly, a mosquito forceps is thrust through the lower flap of the aponeurosis one-fourth to three-eighths inches from the margin, and the free end of the tendon caught and drawn through. The mosquito forceps are then pushed through the opposite side, the tendon is again drawn through the aponeurosis,

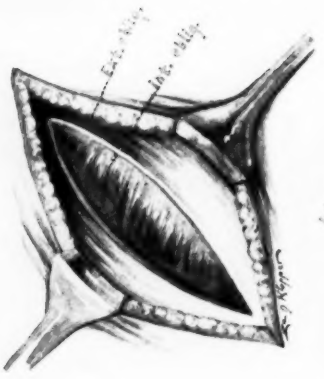


Fig. 1.

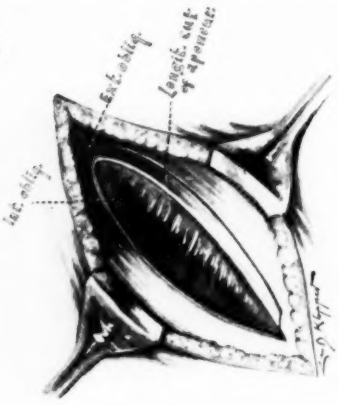


Fig. 2.

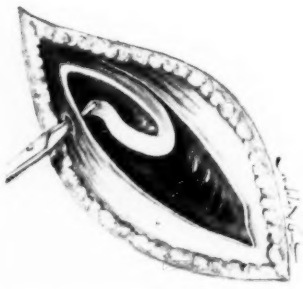


Fig. 3.

Fig. 1. Exposure of external and internal oblique.
Fig. 2. Longitudinal incision in aponeurosis.
Fig. 3. Aponeurotic strip used for suture material.

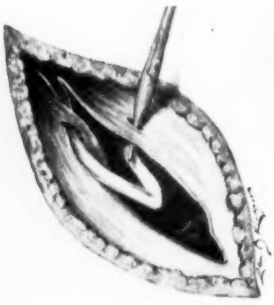


Fig. 4.

Fig. 5.

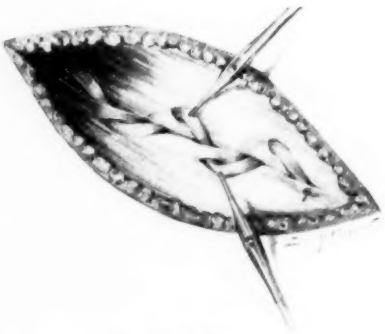


Fig. 6.

Fig. 4. Mosquito forceps, thrust through the lower flap of the aponeurosis, are used to pull the aponeurotic strip through the muscles.
Fig. 5. One catgut suture is used to hold cut end of aponeurotic strip.
Fig. 6. Strip laced instead of sewed.

and this procedure is continued until closure is complete. The free end of the tendon is secured with a single suture of catgut. I do not use silk threaded in a needle as originally suggested or the needles employed by Gallie (2) when detached strips of fascia lata are used.

The manner of introduction of the forceps through the aponeurosis will determine whether the free edges are laced or sutured. I have used both methods and either gives a quicker closure than do the methods usually employed.

## REFERENCES

1. McArthur, L. L. Autoplastic sutures in hernia and other diastases. J. Am. M. Ass., 1904, October 8.
2. Gallie, W. E., and LeMesurier, A. B. Living sutures in the treatment of hernia. Canadian M. Ass. J., 1923, July.

# RECONSTRUCTION OF THE TRACHEA[1]

By FRED R. FAIRCHILD, M.D., Woodland, California

PROBLEMS to be solved in reconstruction of the trachea are interesting; opportunities for putting the solution to practical tests are rare. From both the theoretical and the practical point of view a discussion of the subject would seem worth while.

Plastic operations to relieve stenosis or to close postoperative or traumatic fistulæ are relatively common. This paper is not directly concerned with these conditions. Reference to them is made to point out the fact that the technique that is satisfactory for such repair cannot be applied should there be a complete loss of continuity in the tracheal tube.

By "reconstruction" is meant not the repair of a defect, but the rebuilding of a new, complete segment to restore that portion of the trachea which has been lost.

It is not necessary to apologize for making an experience with one case the excuse for this paper. Those conditions causing immediate loss of all of a trachea segment without destroying life are uncommon. No surgeon can hope to have an experience with a large number of these patients. Deductions as to the best methods of repair must be drawn from mass experience.

Interest in the literature became excited by the dearth of contributions. There is much on methods employed to relieve tracheal stenosis. There are numerous articles on the technique employed to close tracheal fistulæ. In no case report that we were able to find was complete loss from trauma in the continuity of the tracheal tube.

Velpeau published in 1832 a book by title *New Elements of Operative Medicine*. In the chapter on "Air Passages" is given the most interesting review of all that had been previously written on surgery as it related to the trachea. He is authority for the historical data immediately following.

Antyllus and Paul of Egina in the seventh century were the first to describe opening the trachea for any cause. The Greek authors rejected the thought of it in the belief that injury to the cartilage would be fatal.

Rhazes, an Arabian physician of the ninth century, advised tracheotomy in cases of imminent suffocation. About the twelfth century Albukassim, in order to prove that a divided cartilage would heal, cited the case of the complete recovery of a young girl who had partly severed her trachea. Further to prove his belief he discussed the work of Avenzoar who, with the same end in view, had successfully experimented on

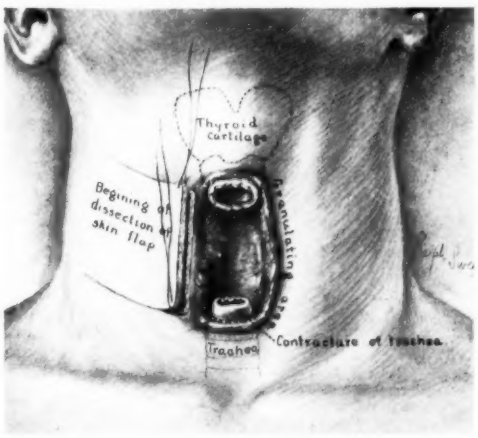



Fig. 1. Three months after injury the wound was a healthfully granulating sulcus with the lower end of the larynx and the upper end of the trachea exposed as shown.

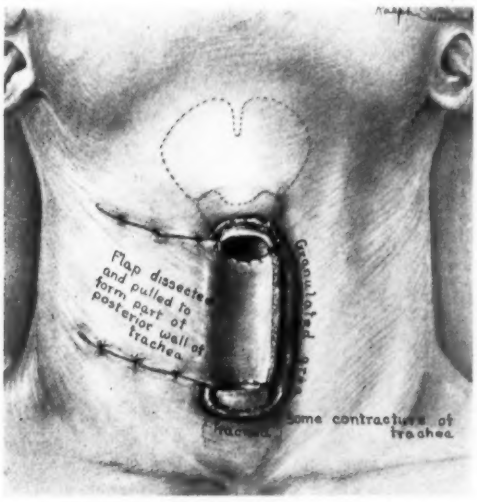



Fig. 2. The right half and posterior surface of the sulcus covered with skin-fat flap which was sutured to corresponding portions of tracheal and laryngeal segments.

[1]Read before the Pacific Coast Surgical Association, February 27, 1926.

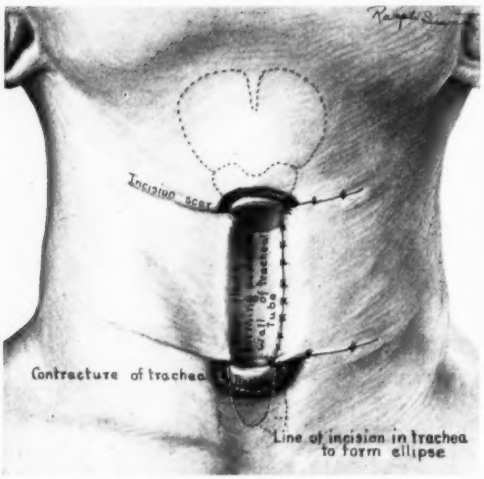



Fig. 3. Left half of sulcus covered by skin-fat flap from left side of neck.

goats. Three hundred years then elapse without reference to further tracheal surgery. We then find reports of tracheotomies again being performed by Benivieni and Brassavole. It is only since Aquapendente, an Italian anatomist and investigator of the sixteenth century, that all writers have admitted its usefulness.

Following this is recorded an occasional opening of the trachea to avert suffocation when the upper air passage had been closed by œdema in association with inflammation. The procedure never came into general favor until Velpeau's own era. He speaks enthusiastically of tracheotomy in several cases of laryngeal diphtheria.

Fig. 5. Photograph of patient after operation.

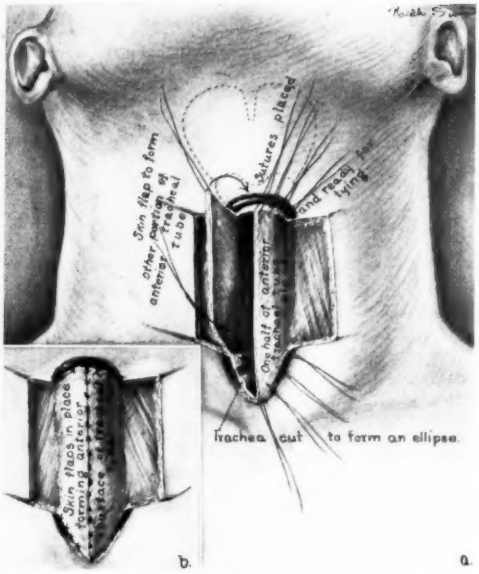

Skin flap to form other portion of anterior tracheal tube
Sutures placed and ready for tying
One half of anterior tracheal tube
Skin flaps in place forming anterior surface of trachea
Trachea cut to form an ellipse.
b.
a.

Fig. 4. (a) Original flap from right and left side of neck cut and reflected to complete anterior portion of new formed tracheal tube. (b) Tracheal tube completed. The superficial surface not yet covered by skin flaps.

Reviewing the literature, ancient and contemporaneous, Velpeau described in detail various modifications of tracheotomy. His discussion of technique directly relating to the subject of this paper is summed up very briefly under the title *Bronchoplastique*. He suggests that in case of necessity a skin flap tube might be formed by rolling a cutaneous fragment over a cork. Presumably this tube was to be inserted to fill in a gap in the trachea. The details are too indefinite to be helpful. No experience is cited in which the method was tried.

Until the work of Fritz Koenig in 1896 we have records only of surgical procedures instituted to save life, done at the expense of the future integrity of the windpipe. Fistulæ and stenoses were anticipated as the ultimate result of these measures.

Koenig recognized the difficulty in tracheal repair by elastic flaps. He observed that the factor of negative pressure during inspiration and cicatricial contracture subsequently caused col-

lapse of the soft tissues with obstruction. To overcome this he transplanted a piece of rib to the subcutaneous tissues of the neck. Later this skin and underlying bone were swung as a flap over the defect to close it with an elastic wall. In 1900 von Mangoldt reported the use of sternocostal cartilage transplanted as in the method of Koenig, for repair of a tracheal fistula. No credit is given Koenig as the originator of the essential principles of the operation. Its use is recorded by him in only one case. Before the German congress of surgeons he verbally reported the use of the method in one other case.

Kindig of von Hacker's Clinic reported from 1902 to 1921 six successful tracheoplasties. The technique used in all cases was essentially that of Koenig and von Mangoldt, there being some minor modifications by von Hacker. Professor K. Henschen reported three tracheal repairs which differed from the technique just described only in the fact that the bone transplant was taken from the clavicle and was nourished by being inserted in a pedicle graft made in close approximation to the contemplated site of repair. The most interesting part of his contribution had to do with a discussion along theoretical lines of the method that had been employed or the means that he felt might, if employed, be successful.

Summarizing the review, one is impressed with the fact that all recorded operative procedures had a limited purpose, viz., tracheotomies to prevent suffocation and plastics to relieve stenoses and to close fistulæ. In this respect the case to be reported is different. Only those facts in the history that have a bearing on the surgical procedure will be recorded.

H. M., aged 20, of excellent family and past history, was in an automobile accident June 20, 1924. His serious injury was due to crushing of the neck. When he was seen at the clinic a few minutes later death seemed imminent from suffocation consequent upon a concealed severance of the trachea. The diagnosis was obvious from inspection, the soft tissues of the neck being retracted on inspiratory effort and distended on expiratory effort. The trachea could not be palpated although the patient had a long, thin neck. In its normal site there was felt a trough-like depression.

Without surgical preparation the neck was split longitudinally from the larynx to the upper border of the sternum. The edges of the wound being retracted much blood and mucus was aspirated by negative pressure. The upper extremity of the lower segment of the divided trachea was identified at the level of the upper border of the sternum. It was seized with Allis' forceps and pulled upward. Evidently the normally rather loose posterior attachment of the tube had been torn away permitting considerable retraction. The segment was sutured in approximately normal position. The laryngeal and tracheal tissue for a space of 3.5 centimeters was badly fragmented and devitalized. Its loss by infection and lack of nutrition was anticipated. A tracheotomy tube was inserted.

Details of the history for the next 8 weeks have to do with the care of aspiration pneumonia, periods of threatened asphyxiation, and other complications not pertinent to the purposes of this paper. Serious wound infection occurred. The inflammatory reaction was extensive, being increased by the great amount of badly traumatized soft tissue. The 3.5 centimeters of fragmented tracheal structure was lost. In addition to this there was left an unusual amount of scar tissue. This fact is important in that it was a determining factor in the selection of a method for reconstruction.

Eight weeks after the injury the patient's general condition and the status of the wound justified the first step in an attempt at repair. The wound in the neck was healthfully granulating. We had purposely kept it packed open, so that it appeared as a longitudinal groove about 3 centimeters deep and 4 centimeters wide at the surface. It terminated at the fragmented lower border of the larynx above and at the upper extremity of the tracheal segment below. The tracheal opening was showing a stubborn tendency toward stenosis. The laryngeal opening, being much larger and being surrounded by much less scar tissue, showed little tendency to close.

The plan for reconstruction contemplated the substitution of a skin tube for the missing tracheal segment. This tube was to be formed by three separate operations. In the interest of clearness and brevity the steps as originally planned will be described, such modifications as were necessary being noted subsequently. Combined local and regional anæsthesia was to be used.

The first operative procedure anticipated bringing from the lower right side of the neck a skin fat flap of sufficient length and breath to cover the entire posterior surface and the adjacent side of the granulating channel. The edges of this flap were to be accurately approximated to the corresponding portions of the edges of the laryngeal and tracheal segments. As a necessary factor in this procedure, sufficient time was then to be permitted to elapse to allow a reliable estimate of changes from contracture.

The second operative step was to be similar to the first. The flap was to be taken from the lower left side of the neck. Its end was to be sutured to the end of the first flap and, like its fellow, to be correspondingly united to the exposed edges of the trachea and larynx.

Our repair would then have progressed to the restoration of the trachea bilaterally and posteriorly. Again there was to be a period of observation to estimate the degree of contracture and to permit us to assure ourselves that the lines of union between the flaps and the trachea and the flaps and the larynx were smooth and satisfactory.

The third operative procedure contemplated severing the pedicle of each lateral flap in lines about one and a half inches from the median line

and parallel to it. Through these lines of severance on either side, dissection was to be made in the subcutaneous fat toward the median line. This would form two new lateral flaps. These flaps being turned forward and inward and united to each other and to the anterior portions of the tracheal and laryngeal segments would complete a skin tube in the position of the missing portion of the trachea. To cover the raw surfaces of these newly inverted flaps by a plastic dissection would be a simple matter.

Since the theoretical reconstruction was in fact carried out successfully only the modifications found necessary to the practical execution of the work will be mentioned. They were as follows:

By reason of trauma and infection the skin on the right side of the neck adjacent to the wound was so altered in structure as to be unfit for use. For this reason a long pedicle flap was taken from the right pectoral region. This was swung across and used as suggested in the first step of the proposed operation. It served its purpose excellently. The pedicle graft was transplanted on August 17, 1924, the pedicle being severed on September 21.

The patient was discharged and asked to report at intervals for observation. It was desired to permit the maximum amount of contraction to occur so that we might better estimate what the probable degree of stenosis would be from the completed operation. On January 3, 1925, approximately 3 months later we felt assured of two things: The first was that by the method selected the lumen of the proposed tube would be ample, that it would not collapse, and that there would be no troublesome stenosis at the skin-laryngeal line of union. The second point of which we were equally, though less happily, assured was that some modification of the plan would be necessary to prevent stenosis at the skin-tracheal junction. Finger dilatations were already necessary and the resistance to dilatation was becoming constantly greater. It was obvious that the amount of contraction in the line where the skin joined the trachea was going to be so great as to cause stenosis. This line of union formed the circumference of a circle in a plane at right angles to the axis of the tube. Obviously the length of this circumference could be increased, easily doubled, by cutting the anterior portions of the tracheal rings lower, thus converting the circular line of union into an ellipse—a procedure reserved for the third stage of the operation.

On January 3, 1925, the second step was successfully completed as in the original plan. We then had three-fourths of our repair completed. The lateral and posterior walls of the new tube were continuous with the trachea below and with the larynx above. This reconstructed portion of the trachea gave promise of a considerably larger diameter than that of the normal windpipe.

On March 22, ten weeks after the second operation, the third or final step in the operative procedure was accomplished in accordance with our original plan except for the modification noted of making an elliptical, instead of a circular, union of the skin flap with the trachea.

The patient was dismissed on May 31, 1925, with no material impairment in respiration and with a fair voice. The vocal deficiency was due to lack of function of the right vocal cord, a condition which was anticipated, for the notes of the original operative procedure recorded the observation that the right recurrent laryngeal nerve had probably been severed at the time of the accident. Follow-up reports indicate that the injured man is able to do full manual labor with no dyspnœa except on extreme exertion.

From this experience we are justified in concluding that a segment of the trachea may be replaced by a skin flap tube and that it is not necessary to reinforce this tube by bone or cartilage. It is our belief that the success of this operation was due to the three-stage procedure—the tube being built in segments, each segment being allowed to seat and contract before the next segment was placed. It would not seem practical to complete the tube at one operation. Cicatricial contracture and collapse would certainly defeat the purpose if this method were employed.

We were fortunate in having as a subject a young man without hair on the lower part of his neck. In one with hair the same method could be used except that long pedicle flaps would be necessary to bring desirable tissue to the site of repair.

## BIBLIOGRAPHY


1. Hacker, von. Wien. klin. Wchnschr., 1906, 1.
2. Henschen, K. Der plastische Wiederaufbau des verengten oder obliterierten Kehlkopftrachealrohres. Schweiz. med. Wchnschr., 1920, No. 25, p. 512.
3. Jackson, C., and Keen, W. W. Cicatricial tracheal stenosis. J. Am. M. Ass., 1924, lxxxii, 2027.
4. Kindig, G. O. Ein Beitrag zur von Mangoldtschen und Koenigschen Tracheoplastik, etc. Arch. f. klin. Chir., 1924, cxxxi, 343.
5. Koenig, Fritz. Berl. klin. Wchnschr., 1896, No. 51.
6. Mangoldt, von. Arch. f. klin. Chir., 1900, xli, 954.
7. Pfeiffer, C. Ueber plastischen Verschlusz grosser Larynx-Trachealdefekte. Zentralbl. f. Chir., 1921, xlviii, 965.
8. Schmidt, C. Casuistischer Beitrag zum plastischen Wiederaufbau des Laryngotrachealrohrs. Schweiz. med. Wchnschr., 1922, p. 539.
9. Velpeau. Nouveaux Eléments de Médicine Opératoire. Paris, 1832.

# ELECTROCOAGULATION SNARES

## For Tonsil and Intranasal Surgery and for Benign or Malignant Growths

By A. R. HOLLENDER, M.D., and M. H. COTTLE, M.D., Chicago

SURGICAL diathermy may be employed as electrocoagulation or as electrodesiccation. *Electrocoagulation* is used primarily for the destruction of new-growths and implies tissue coagulation, "not burning, charring or incineration." *Electrodesiccation* is a process of surface tissue dehydration.

The heat which these methods produce is generated by the resistance of the tissues to the current and is of greatest intensity at the smaller or active electrode, where the lines of electrical force are concentrated. Electrocoagulation is a biterminal method; electrodesiccation, a monoterminal method.

When properly performed, surgical diathermy has few disadvantages. Caution must, of course, be exercised in order to avoid the destruction of important uninvolved anatomical structures. Secondary hæmorrhage as a likely sequence must also be recognized.

Surgical diathermy offers many distinct advantages, among which are (1) absence of hæmorrhage, (2) sealing of lymphatics, and (3) sterilization of parts operated upon. When employed for malignant tumors, several additional advantageous features are the safety of treating otherwise inoperable tumors and the limitation of metastases.

Electrocoagulation and electrodesiccation are being employed rather extensively as substitutes for tonsil enucleation. These methods are inferior to any of the accepted surgical procedures because there is no way to determine the depth of tissue destruction and because the tonsil sloughs out partially or totally at an indefinite time subsequent to operation. The heat necessary to destroy the tonsil produces marked œdema and may even do damage to adjacent tissues. Secondary operations are frequently necessary to complete the removal of the tonsillar tissue.

For the treatment of tonsillar remains, such as so-called "stumps," electrodesiccation is an ideal method. Also, in those cases in which surgical removal is refused or contra-indicated, the partial destruction of tonsils, performed bloodlessly, is sometimes not without merit and benefit.

The high frequency or "radio" knife is now employed by some surgeons for tonsil dissection. The tonsils are removed by a shower of sparks. The sparking produces a charring of the tissues which results in partial control of bleeding and sealing of lymphatics. While this procedure has given good results in the hands of some operators, it has not been widely adopted. This is due to the fact that the dissection depends on the shower of sparks and the uncertainty of controlling hæmorrhage despite vigorous sparking. The procedure is also time-consuming and for most operators quite difficult.

### TONSIL ENUCLEATION

We are indebted to Dr. D. Kobak, of Chicago, whose plans we have used in the construction of an instrument for the enucleation of tonsils with electrocoagulation. The instrument is a simple modification of the Beck-Schenck tonsillectome. The handle was left unchanged, save that provision was made for connection with a diathermy apparatus. The terminal fenestrated shank is made of hard rubber to insure insulation. The fenestrum is fashioned round instead of oval and is somewhat larger than the usual Vedder loop.

The technique of operation is as follows: A biterminal d'Arsonval current is used. A sheet of block tin (5 inches by 8 inches) is approximated firmly to the abdomen or back and serves as the indifferent electrode. The patient is anæsthetized in the customary way. While this is being done, the instrument is attached to the low voltage terminal of the apparatus, a foot switch is installed for the control of current, and the current set for 300 to 400 milliamperes. The spark gap should be closed and the diathermy apparatus placed at least 3 to 4 feet away from the patient. When the patient is anæsthetized with ether, the ether can and mask are removed from the room before the operation is begun.

For the right tonsil, the instrument is held in the right hand. The tonsil is first engaged as in the usual Beck operation. This is attained by picking up the inferior and posterior portions of the tonsil with the fenestrated end of the instrument, and pressing the rest of the tonsil through the fenestrum with the middle or forefinger of the other hand. The wire is pulled down around the tonsil as far as it will go without forcing, and locked. If the tonsil is properly engaged, a small dimple in the anterior pillar will be seen. An assistant grasps the tonsil with a tenaculum and exerts steady moderate traction anteriorly and

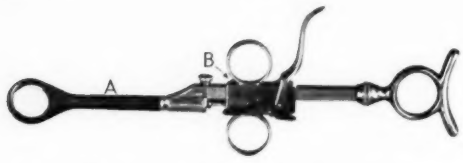



Fig. 1. Modification of Beck-Schenck tonsillectome. *a*, Represents the insulated portion of the instrument; *b*, binding post (on opposite side) for connection by cord to diathermy apparatus.

Fig. 2. The nasal snare used for electrocoagulation. The terminal portion is insulated. *a*, Binding post; *b*, the insulation consists of a jacket of hard rubber; *c*, brass holder for fastening jacket.

medially. The operator supports the instrument in one hand and holds the wire-tightening screw in the other. The foot is placed on the foot switch. The current is turned on for a half to one second. The hand holding the tightening screw will feel the release of tension, which calls for the termination of current. Sparking should not occur. The wire is tightened again without forcing, and the current turned on. The release of tension is again felt. The tightening is repeated and the operation continued. Three or four such phases are necessary for the removal of the tonsil. Bleeding does not occur at all, or, occasionally, in a very negligible amount, when the wire has been forced prior to the turning on of the current.

The left hand holds the instrument in removing the left tonsil, and the technique otherwise is identical with that described.

The entire operation should not consume more than a few minutes, thus rendering resumption of the anæsthetic unnecessary.

The postoperative course is favorable. Secondary hæmorrhage has not occurred. The local reaction is perhaps less than that following a clean tonsillectomy. There are no untoward systemic reactions. Healing occurs in the usual time, leaving softer scars and less distorted looking pillars.

Postoperative care of the throat includes aspirin gargle, cresatin topically to the tonsillar fossæ, and occasionally, exposure to the ultraviolet rays.

Several tonsils removed in this manner were studied, microscopically, by Dr. J. J. Moore, of Chicago. Coagulation necrosis was observed at the site of operation extending to a depth of only two to three cells.

### INTRANASAL SURGERY AND BENIGN OR MALIGNANT GROWTHS

Electrothermic methods are as yet not extensively used in intranasal surgery. This is probably due to the fact that rhinologists have not acquainted themselves with the possibilities of surgical diathermy.

The nasal snare used for electrocoagulation is one the terminal portion of which is insulated and it is also provided with a binding post, *A*. The insulation of the snare illustrated consists of a jacket of hard rubber, *B*, which slips over the metal tube of the snare and is fastened into the brass holder, *C*. The snare has been utilized by us principally for the removal of polyps and for the partial resection of turbinates.

Local application of cocaine or apothesin gives satisfactory anæsthesia for this work.

The diathermy cord is connected to the binding post on the snare and a large indifferent electrode applied to the back, abdomen, arm, or leg.

The technique for coagulation is similar to that described for tonsil enucleation. A current of 200 to 300 milliamperes is ample, but if bone is to be removed 400 to 500 milliamperes are necessary.

The snare is adaptable to use for small benign or malignant tumors anywhere, but especially if these are situated in the regions of the nose, throat, larynx, and eye.

### CONCLUSIONS

1. For tonsil enucleation, the method should be undertaken only by one who is thoroughly familiar with the Beck instrument and technique, as well as surgical dissection of tonsils.
2. The method insures a bloodless removal of the tonsils at one sitting with comparatively small danger of secondary hæmorrhage and absorption of toxins by the lymphatics, and without the occurrence of sparking.
3. The nasal coagulation-snare is well adapted for the removal of polyps or for partial removal of turbinates and does away with hæmorrhage usually incident to these operations.
4. This instrument is of decided advantage for removing *en masse* small benign or malignant tumors.
5. The depth of the tissue coagulation which is produced by either the tonsil or nasal snare is minimal and sloughing is, therefore, negligible.

# EDITORIALS

SURGERY, GYNECOLOGY AND OBSTETRICS

FRANKLIN H. MARTIN, M.D.....Managing Editor
ALLEN B. KANAVEL, M.D.....Associate Editor

WILLIAM J. MAYO, M.D.....Chief of Editorial Staff

JANUARY, 1927

## BOARDS ON MEDICAL MOTION PICTURE FILMS AND TRAUMATIC SURGERY

THE constructive action taken at the recent Clinical Congress of the American College of Surgeons in Montreal with regard to the development and use of motion pictures in the field of medical education and in the regulation of procedures for the treatment of the injured, gives evidence of vision and progressive activity.

Efforts for the utilization of motion pictures in medical fields have heretofore been more or less sporadic. Some have been well worth while and others of little consequence. To those who have given thought to the future and have recognized the modern day advancements in motion picture production, there is no question as to the value of the film for the instruction of physicians, students of medicine, and the public. The question has been: "Where could reliable films be obtained which are true to facts and fundamental principles and meet the ethical requirements of recognized medicine?" A definite source of centralization of information and an assurance of reliability will go far toward developing the use of medical films. This move on behalf of the College of Surgeons, with the co-operation of Mr. Will Hays and the Motion Picture Producers and Distributors of America, Inc., will assure a supply of reliable films depicting the operation and not the operator, and emphasizing the subject matter for the benefit of students, be they graduates, under-graduates, or laymen. It is a step in the right direction for the future development of medical education.

In this age of high-speed living with rapidly increasing industrial enterprises, we must look well to the care of the injured. It is pertinent to ask whether our present practices in this regard are established upon principles which assure the highest type of service to these patients. In fact, a guarantee of competent care of the injured is timely, as it anticipates a demand which otherwise would develop sooner or later from sources other than medical. In traumatic surgery as in the standardization of hospitals, the American College of Surgeons has kept in mind the interests and welfare of the patient. The report of the research group of the Committee on Traumatic Surgery has revealed much of consequence. It justly brings up the question as to whether the injured are receiving proper surgical care and whether these patients are always treated by those best qualified to handle such cases. It is well known that disability periods are frequently prolonged out of proportion to the injury; and that this works a hardship both upon the individual and those liable for the disability is without question. The theory of aggravation of certain diseases due to injury is frequently overworked and carried

beyond reasonable bounds. All these points are well taken by the Committee and have been followed by a suggestion that more knowledge relative to compensation and medicolegal matters should be imparted to the students in our medical schools.

The Board appointed by the Regents of the American College of Surgeons for the purpose of undertaking definite activity in the care of the injured will find a fertile field for its endeavor. It will, without doubt, confer a lasting benefit both upon the public and the profession.

In establishing methods of more efficient medical teaching through the use of motion picture films and in regulating the practice of traumatic surgery, the College of Surgeons is initiating great humanitarian and economic public services worthy of the highest commendation.

Detailed reports of the Boards on Medical Motion Picture Films and Traumatic Surgery appear on pages 142 to 144 of this issue.

## SUNLIGHT AND ULTRAVIOLET RADIATION

IT is claimed by those who are considered competent to express opinions that the medicine of the future will be largely preventive in character and that it will partake of a greater realization on the part of the average person that man, while being a triumvirate of body, mind and soul, in which he is forced to persecute his body to some degree in the interests of his mind as so-called civilization advances, must give more and more heed to the fact that he is, first of all, an animal. Man as an animal, therefore, will be taught to partake to a greater extent of the benefits of the natural tonics and medicines of Nature: light, heat, water, air, and sleep. We know that there are diseases of darkness: chief of these is rickets, a disease that made its appearance when man became civilized and covered himself with garments and clothed himself in much fine raiment rather than in Nature's coat of tan. We also know that our foods are literally canned or bottled sunshine and that these foods contain not only the ordinary, dead atoms and molecules of carbon, oxygen, hydrogen and like elements, but that they also have stored up within themselves that intangible something which we call the energy of the sunlight. For the chlorophyll of the plant works under the light as the activating agent or transcendental medium whereby the carbon dioxide and the water are synthesized into starches and sugars. Carbon dioxide plus water means nothing but a physical solution at best: carbon dioxide plus water plus sunlight means life. As Dorsey says: "The lilies of the field toil not: the sun does it for them, using the carbon dioxide of the air and the water. The cattle of the field have to go to the lilies: the lilies will not come to them. Cattle toil with the sun's energy of green grass. We too are children of the sun and toil with its energy stored in food plants."

The sunlight is the agent of union: it literally brings the lifeless to life. According to our modern electronic theories, we may conceive of this as being due to the fact that the energy contained in certain wavelengths of light ionizes the atoms in complex chemical substances and gives them new activities and powers. For after all is said and done, an ionized atom or molecule of calcium, phosphorus, or what not, is not the same entity as an un-ionized molecule or atom, anymore than isomers are the same substances, although of like formulas.

Most plants and animals, including man, are as dependent for normal growth and development on the short wavelengths of sun-

light, known as the ultraviolet rays, as they are on heat energy which, in large measure, lies in the infra-red radiations of sunlight. Bone development and other physiological functions are interfered with when the organism is deprived of a certain amount of ultraviolet radiation. Ultraviolet radiation has been shown to be of great practical importance in curing "weak legs" in growing chickens. Presumably this defect is rickets or closely allied to it and is due to the absence of vitamin D in the diet. Rickets in chickens can be cured by mixing cod liver oil with the food, by giving the chicks free access to outdoor runways where they may enjoy the sunlight or by exposing them for a few minutes a day to the radiation from an air-cooled ultraviolet lamp. Such experiments on animals would not, however, prove the efficacy of such treatments in cases of rachitic children. Dr. Harriette Chick of England, had an excellent opportunity in Vienna, immediately after the war, of proving that rickets can be cured in the human species, just as in the rat or fowl, by any or all of these three methods.

Apparently, also, in the absence of ultraviolet rays, the body is more susceptible to the inroads of disease. It is quite definitely proved that there is a marked tendency to anæmia in many of those who live indoors a considerable portion of the winter months: with this condition, therefore, and with lack of exercise, fresh air and controlled diet, it is entirely possible that influenza, grip, and ordinary colds may hold sway. Window glass, which absorbs a considerable part of the ultraviolet, has unquestionably accelerated the advance of civilization, but man has paid the price. It is a question as to whether or not a considerable number of the diseases which now afflict us are the products of our own manufacturing or civilization, a civilization in which the tangible self, the body, is subjected too much to man-made laws and too little to Nature's laws. At any rate, experiments appear to indicate that when the absence of the ultraviolet part of sunshine in our homes in the winter is compensated for by light baths from sources rich in ultraviolet, temporary anæmia disappears, the general condition of health is nearer normal and we pass into the springtime without that "pepless," "all-in" feeling that so many experience, as well as avoiding the old sulphur and molasses treatment which was, when some of us were boys and girls, just as much an accompaniment of Spring as the return of the robins and the appearance of the arbutus.

The storage of sunshine and the absorption of ultraviolet energy in tissues are intricately complex. Of the luminous radiations, those centered around the yellow and green regions of the spectrum penetrate more deeply into the skin and tissues than those rays at either the red or blue end of the spectrum. Perhaps this energy, thus absorbed, is converted into heat. Possibly all of the observed therapeutic effects ascribed to light may be accounted for on the basis of their production of heat beneath the surface of the body. However, from the voluminous amount of experimentation which has been carried on, we may conclude that the long ultraviolet wavelengths, which constitute the whole of the ultraviolet component of sunlight at the earth's surface, are molecular and atomic in their action, influencing particularly the nuclei of the cells they reach.

Perhaps, as Sheppard says, "We are only at the beginning of the conscious utilization of the powers of light as distinct from the unconscious enjoyment of them."

CHARLES SHEARD.

# MASTER SURGEONS OF AMERICA

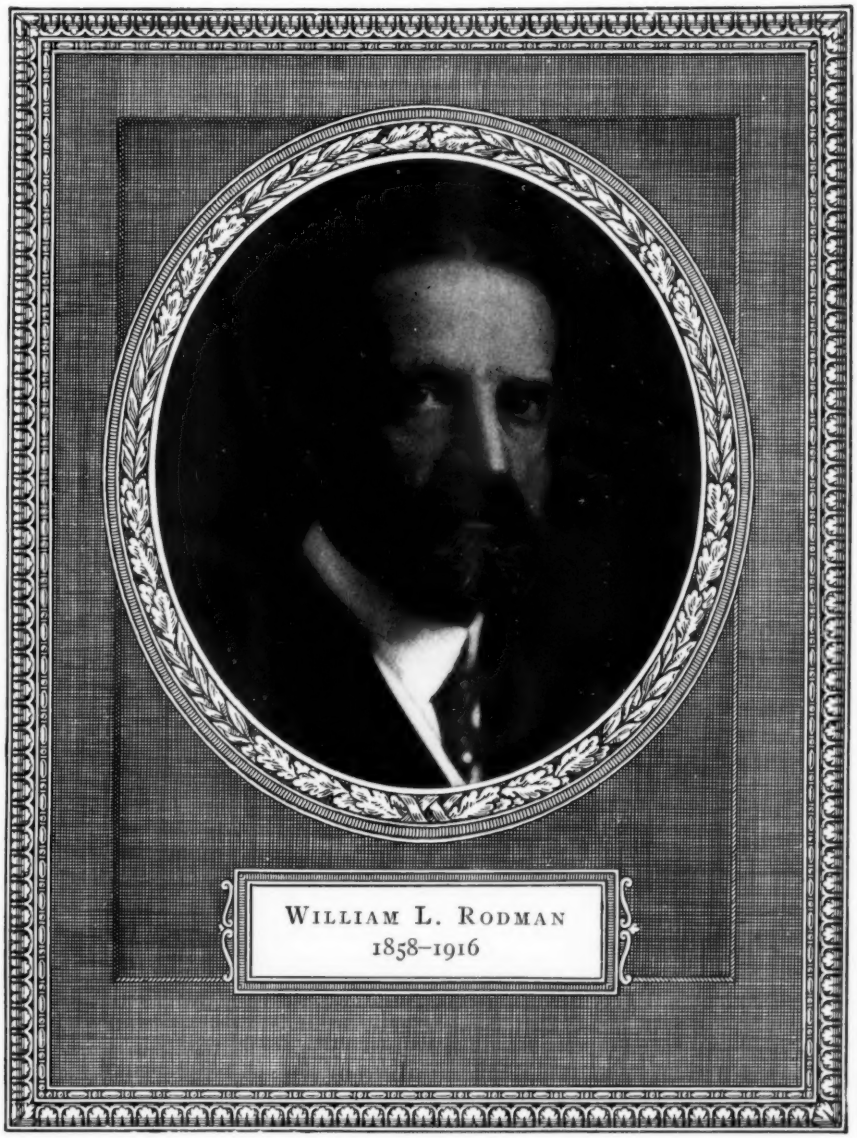
## WILLIAM LOUIS RODMAN

WILLIAM LOUIS RODMAN was the second son and the fourth child of John and Harriet V. Rodman, having been born at Frankfort, Kentucky, on September 5, 1858. At the time of Dr. Rodman's birth his father was attorney general of the state and enjoyed a large law practice in Frankfort. Dr. Rodman received his early schooling in Frankfort and at the Kentucky Military Institute from which he graduated with the degree of master of arts in 1877. His early interest in medicine was stimulated by his kinsmen, Drs. W. B. and James Rodman, each of whom had been successful in his chosen field of general practice and neuropsychiatry, respectively.

William L. Rodman entered Jefferson Medical College, Philadelphia, in the fall of 1877 and graduated in 1879. He and his close friend, Dr. W. L. Kneedler, then became the first two internes in the Jefferson Hospital where he served during the years 1879 to 1880. It was in this Hospital that Dr. Rodman came under the stimulating influence of that master of surgery of his day, Dr. Samuel D. Gross, and of the latter's gifted son, Dr. Samuel W. Gross. From the younger Gross he received his early training in surgery of the mammary gland, a subject which later in his life commanded a large part of his interest.

Upon finishing his year of interneship at the Jefferson Hospital, Dr. Rodman entered the Medical Corps of the United States Army as a contract surgeon. He was stationed at Fort Sill, then Indian Territory, for 18 months and had, during that time, many interesting experiences in Indian raids. In the service of the Army he made many friends whom he enjoyed throughout his life; in fact his last act was to help to secure the passage through Congress of a bill in which the Medical Corps of the Army was vitally interested. He also made many friends among the Indians, seeing much good in the traits of the best of them.

The Medical Corps did not offer him, he believed, as good an outlet for his surgical ambition as did civil practice, so in 1882 he resigned, returned to his native state of Kentucky to marry Bettie Crawford Stewart, the eldest daughter of Dr. J. Q. A. Stewart, and as at the moment there was no opportunity for him there, he accepted an offer to assist his cousin, Dr. John Rodman, with a rapidly growing general practice at Abilene, Texas. He spent two very busy years at Abilene but feeling that the ambition of his life to practice and teach surgery



WILLIAM L. RODMAN
1858–1916

could no longer be delayed, returned again to Kentucky where he established himself in Louisville. Dr. Rodman was again fortunate in that he then became associated with Dr. David W. Yandell, the professor of surgery at the University of Louisville and the most gifted of southern surgeons. Dr. Yandell had few equals as a teacher of surgery and it was from him that Dr. Rodman received his start in surgical teaching, a part of his work which he always enjoyed. For 7 years he served as prosector, demonstrator of operative surgery, and chief of clinic under Dr. Yandell at the University of Louisville. In 1891 he became professor of surgery in the Kentucky School of Medicine in Louisville, serving in this capacity until he accepted the chair of the principles and practice of surgery in the Medico-Chirurgical College in Philadelphia, in 1898. His work both in the operating theater and in surgical literature during these years won for him national recognition, as is evidenced by his election to the chairmanship of the surgical section of the American Medical Association in 1898 and also to fellowship in the American Surgical Association. He served at one time as president of the American Medical College Association.

Dr. Rodman's career from the time of his coming to Philadelphia in 1898 to the time of his death in 1916 was varied in its interests between teaching, an active surgical service in several hospitals, and the affairs of the American Medical Association. He served the latter body as trustee after being chairman of the surgical section, and in 1915 was elected its president, holding this office at the time of his death in March, 1916.

The two subjects which occupied his greatest surgical interest were the mammary gland and the stomach. In 1908, he published his monograph on "Surgery of the Mammary Gland with Especial Reference to Carcinoma." The technique for radical amputation of this gland evolved by him at that time and used so successfully by him and many others since, was one of his chief contributions to surgery. In his oration in surgery in 1900 to the American Medical Association, he was the first to advocate partial gastrectomy for ulcer of the pylorus, a principle which has proved so sound as to be the accepted practice of the day. In 1915 while president of the American Medical Association he founded the National Board of Medical Examiners. He did not live to see its first examination held in October, 1916, but this board has since its organization grown to an established place in medicine in this country and abroad.

He died of pneumonia on March 8, 1916, after an illness which had lasted only 5 days. He was then but 58 and at the height of his usefulness. Dr. Rodman had during his day no superiors and but a few equals as a surgical teacher. His command of English was exceptional as shown in his lectures and many contributions to surgical literature. He was a natural leader of men and left the surgical world the better for his having played his part.

JOHN STEWART RODMAN
WILLIAM J. MAYO

# TRANSACTIONS OF SOCIETIES

## CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING HELD APRIL 16, 1926, DR. DAVID S. HILLIS PRESIDING

### SPECIMEN OF PLACENTA FROM A SET OF TRIPLETS

DR. RALPH REIS: The placentæ presented are from a set of triplets born on Dr. Joseph L. Baer's service at Michael Reese Hospital. The point of interest is that there is one single placenta and one fused placenta. To the fused placentæ was attached a male and a female fetus. The question arose of the possibility of two babies with one placenta. On further careful dissection two chorions and two amnions were found. This placenta probably represents the fusion of two separate placentæ. The mother was a primipara, 25 years old, in the thirty-second week of pregnancy. She went into spontaneous labor and delivered a male child weighing 1,190+ grams, 38 centimeters long, from the single placenta. The second baby was a boy weighing still less (1,170 grams), only 37 centimeters long, attached by its cord to the double placenta. The third child, also attached to the fused placentæ, was a girl weighing 1,300 grams, 43 centimeters long. It was an excellent illustration of fusion of placentæ.

### DISCUSSION

DR. J. L. BAER: May I emphasize that there were three distinct ova fertilized apparently at the same time, the fused placenta representing the fertilization of two separate ova, one male and one female, the single placenta being the third. Dr. Reis might have made the further comment that a single follicle containing three ova has been recorded which would explain these three fetuses from one fertilization.

### TWO CASES OF PREGNANCY IN A BICORNUATE UTERUS

DR. HENRY F. LEWIS: CASE 1. Cook County Hospital, Chicago. The patient was white, 28 years of age, and had been married 8 years. She entered on March 8, 1926, stating that her last menstrual period was on December 18, 1925. Ten hours before admission she had a profuse hæmorrhage from the vagina. She denied any interference with the pregnancy. There was no further bleeding. Her family doctor sent her in with the statement that the case was one of tubal pregnancy. She had been pregnant 5 times; 4 times pregnancy ended with abortion at 3 months and once in a full-term still birth.

Physical examination was negative except for the essential pathology. The cervix was firm and directed downward. The body of the uterus was in the midline, was soft, and seemed about as large as a pregnancy of 2½ months. The left tube was apparently thickened. In the right fornix was a fluctuating mass, moderately tender. A later examination showed the cervix softened, the uterus apparently not enlarged in the midline though enlarged somewhat upward and to the right. There was a firm tumor mass freely movable. The left side felt about the same as on the former examination.

The impression was that the uterus was nonpregnant but enlarged on account of an ectopic pregnancy in the left tube. Operation proved the case to be a pregnancy in the right horn of a bicornuate uterus. By vaginal examination the left horn had seemed to be the site of an ectopic pregnancy but proved to be the horn of a bicornuate uterus on ocular inspection. The postoperative course was uneventful except that on the third day abortion occurred. This was a 3 months' pregnancy apparently of the right horn.

CASE 2. West Suburban Hospital, Oak Park, Illinois. This was a case of pregnancy in a rudimentary horn situated on the right side. On January 11, 1926, the patient, who was about at full term, began to have some labor pains. The motions of the fetus suddenly became very much exaggerated and suddenly the baby died, that is, its motions ceased. The patient was left without operative interference. The abdomen gradually decreased in size. Six weeks after the pseudolabor, Dr. W. J. Pollock, who had been in charge of the case, called me in consultation to determine whether an operation should be performed.

The woman was emaciated but the abdomen was enlarged to the size of a 7 months' pregnancy. It was difficult to find the cervix by bimanual examination. It was only by pushing the examining finger (under anæsthesia) far upward to the left that a small cervix was found, pushed tightly up into the left fornix by the bulky mass of the rudimentary horn. Fetal parts could be felt in the abnormal sac. The patient had been in fairly good condition but showed some signs of toxæmia.

At operation the uterus was found attached to nearly all of the abdominal organs by adhesions resulting from attacks of peritonitis and appendicitis which had occurred several years previously. It was impossible to remove the uterus *in toto* because it was so tightly adherent to other structures that the shock and the time necessary would be too great.

Practically, the operation consisted in doing a cæsarean section upon a uterus containing a dead baby. There was found in the uterus only a small amount of bloody fluid. The fetus was partially mummified. The uterine wall was rather thin; its color was dark and its consistency leathery. There had been very little bleeding. The question was how to take care of the uterus. It seemed impossible to remove it or even to remove the rudimentary horn. So it was deemed wise to remove only the upper third of the sac and to marsupialize the rest into the upper part of the wound. The patient did extremely well. Two months after the operation only a small fistulous opening remained.

The left horn was of normal non-pregnant size. This horn had been itself pregnant, because she had borne children normally without undue trouble.

I consider this case one of pregnancy in a rudimentary horn and not in a bicornuate uterus, because the horn could not be entered through the cervix; and because, when the considerable portion of the wall of the rudimentary horn had been removed, an attempt to find the cervical canal through the large sac into the left horn or into the cervical canal of that horn was unsuccessful. It is possible that there may have been a minute hole through the septum between the two horns but this was not to be felt by the finger. Apparently the large rudimentary horn was perfectly blind except for the tubal opening.

### DISCUSSION

Dr. W. J. Pollock: The date of the last menstruation was April 1 to 7, 1925. About April 15 an intermittent flow began and continued for 41 days with nausea and vomiting. From the last of May until June 15 the general condition was very good. About June 15 the patient fainted in the bathroom and was quite sick for 4 weeks with considerable pain in the abdomen and a great deal of nausea and vomiting. On September 7 she felt life. In October she again had quite severe pain with nausea and vomiting. From that time until January 11 she was in bed a great deal of the time with soreness in the abdomen and quite a little nausea and vomiting. At this time she had labor pains for about 8 hours. Then she imagined that she did not feel life. Examination of the abdomen the next morning revealed no fetal heart tones. The child must have died shortly after she imagined she did not feel life. She had had 2 normal pregnancies before with normal labors, one 9 and the other 7 years ago.

At the present time the general condition is good except for the slight fistula.

For 2 or 3 days after the patient had the first severe pains, a discharge of quite a little bright red blood occurred. During the succeeding 6 weeks discolored blood in considerable quantities was discharged. This would point to pregnancy in the tube or in the horn instead of in the abdomen as was suggested by another consultant.

Dr. Irving Stein: A rather interesting case in point is that of a girl 13 years of age whom I saw in the dispensary and followed for about 6 months because of an intense dysmenorrhœa. On rectal examination we were unable to diagnose any abnormality of the uterus. She was sent into the hospital 2 or 3 times under different diagnoses. One was dysmenorrhœa and one was acute appendicitis. The appendix was removed and nothing was discovered by the general surgeon. The dysmenorrhœa was so severe that I directed the doctor to give a hypodermic. She was not a neurotic girl, in between her periods being bright and intelligent.

Dr. Frankenthal made a diagnosis of fibroid. A pneumoperitoneum film showed a bicornuate uterus. At laparotomy Dr. Frankenthal found the bicornuate uterus slightly thickened. He removed a wedge shaped piece, the bridge between the two horns, and uniting the two horns made a single uterus. Since operation, over a year ago, menstruation has not been painful. A recent pneumoperitoneum shows a single uterus with quite a septum leading down to the bicornuate uterus.

Dr. Rudolph W. Holmes: Years ago in a case of hard labor, one interne stated the os had not dilated, the other maintained dilatation was complete. A double vagina and double uterus were then demonstrated; and later the uterine septum ruptured. The horn that had been pregnant was removed. The unimpregnated uterus was the size of a 3 months' pregnancy.

Dr. H. F. Lewis (closing): There was no bleeding when I removed the placenta which was attached very low. There was no tear or solution of continuity in the uterus and very little contraction. The tube was discovered in a rudimentary condition in the upper portion of the sac. The report of the pathologist showed a few muscle fibers and some connective tissue cells.

### CASE ILLUSTRATING THE DANGERS OF THE PROMISCUOUS USE OF INSULIN

Dr. Paul Rhodes: This case is reported at the suggestion of Drs. Lee and Lewis because it offers the rather unusual clinical picture of a woman in the later months of pregnancy in a state of severe hypoglycæmia. It also illustrates the dangers of insulin administration in the hands of practitioners unfamiliar with its use.

Miss G. entered the Cook County Hospital at 9:20 p.m., March 27, 1926, on the service of Dr. H. Lewis. She was brought to the ward in deep coma.

No information about her was available except that gained from a filled-in insurance blank which was found on her person. This stated in answer to three different questions that the patient was suffering from diabetes insipidus. It also stated that the urine was positive for sugar.

Examination showed the patient deeply comatose; respirations 8 per minute, very shallow; pulse 40, weak and irregular. The extremities were white and cold, lips pale; pupils contracted, equal and regular, reacting very slightly to light. No deep tendon reflexes could be elicited. There was no evidence of injury, no acetone odor to the breath, no redness of the cheeks. Examination of the chest and heart were negative except for the excessively slow respiratory and cardiac rates. The abdomen was enlarged to about the size of a 7 months' pregnancy. Small parts were felt to the right with head floating above the inlet. The fetal heart tones were 80 in the left lower quadrant. Fetal movements were very active; blood pressure was 80/40. The catheterized urine showed no sugar when as much as 2½ cubic centimeters of urine were added to 5 cubic centimeters of Haines's solution. No albumin nor casts were found.

The nurses stated that the patient had had a slight convulsion while the internes were on the way to the ward. The possible diagnosis appeared to be eclampsia, diabetic coma, or drug poisoning. The excessively low blood pressure and absence of albumin in the urine were points against eclampsia. The absence of sugar in the urine and the clinical picture, which did not include Kussmaul breathing, acetone odor to the breath, flushed cheeks, etc., seemed to rule out diabetic coma.

Closer examination revealed what was surmised to be a mark from a hypodermic needle in the left cubital fossa. This made the internes think more strongly of morphine poisoning, especially in view of the fact that the patient was pregnant and unmarried. Closer scrutiny of the only available data on the patient, namely the filled-in insurance blank, showed that the physician had associated the diagnosis of diabetes insipidus with glycosuria. The idea occurred to us that a practitioner with this sort of mental equipment might have also made an error in therapy, and that the patient might be suffering from an overdose of insulin. It was reasoned that intravenous glucose would at least do no harm and would be of value if the condition was either severe hypoglycæmia or a toxæmia of pregnancy. Accordingly 30 grams of glucose in 25 per cent solution were introduced into a vein. About 10 minutes were required. The result was striking. Before the glucose administration was finished the pulse had become more rapid and of better quality, the skin warmer, and respiration deeper and more rapid. The fetal heart tones were accelerated and fetal movements slowed. Immediately after the intravenous administration of glucose the stomach was aspirated and the contents saved. A pint of hot coffee and 40 grams of glucose were introduced through the tube. Ten minutes later the patient was conscious; pulse 72, skin warm, fetal heart tones 140 and of good quality. Practically no fetal movements could be noted.

Prior to this time it had been impossible to communicate with the patient's physician because the name signed was illegible. After the patient regained consciousness her doctor was called on the phone. It was learned that he had given her 20 units of insulin intravenously about 2 hours before her admission to the hospital. The basis of this therapeutic measure had been the finding of a trace of sugar in the urine 3 days previously. It was learned from the patient that all she had eaten on the day of admission was a small dish of cereal and a piece of toast.

In an effort to learn whether or not the patient had true diabetes, and to estimate its severity, she was put on regular ward diet for 2 days. Every sample of urine passed was tested for sugar. In only one instance was the Haines test for sugar positive with less than 40 drops of urine to 5 cubic centimeters of the testing solution. The fasting blood sugar was found to be 120 milligrams per liter. On the third day after entrance a sugar tolerance test was run; 100 grams of glucose were given by mouth and simultaneous blood sugar and urine tests for sugar made at regular intervals for 2 hours. Sugar came through in the urine 90 minutes after the ingestion of the glucose. At the end of 2 hours the blood sugar had risen to 200 milligrams per liter. This probably indicated a mild form of diabetes mellitus. The patient was advised to remain in the hospital on diabetic management until delivery. This she refused to do. She elected to return to her own physician "who understood her case better," and who was less enthusiastic about venepuncture as a means of controlling insulin therapy.

## DISCUSSION

DR. J. L. BAER: The acumen shown in this case is worthy of the best traditions of the Cook County Hospital and the recognition of the Chicago Gynecological Society.

DR. J. L. BAER presented a paper entitled "The Renal Problem in Pregnancy."

DR. W. C. DANFORTH read a paper on "The Incidence of Referred Pain to the Shoulder in Ruptured Ectopic Pregnancy."

# THE SURGIONS DIRECTORIE,

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*Divided into* X. *Parts.*

(Whoſe Contents follow in the next Page.)

Written by *T. Vicary* Eſquire, Chyrurgion to *Hen* 8. *Edw.* 6. Q. *Mary* Q. *Eliz.*

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# THE SURGEON'S LIBRARY

## OLD MASTERPIECES IN SURGERY

By ALFRED J. BROWN, M.D., F.A.C.S., Omaha, Nebraska

### THE SURGIONS DIRECTORIE OF THOMAS VICARY

FOR nearly a century after the death of John Arderne, which occurred in the latter part of the fourteenth century, England had no surgeon who rose to a position of any prominence. The slight advance which had been made had been accomplished by concerted action of groups of surgeons and no individual stood out as a leader. There were two main groups or guilds, on the one hand the surgeons and on the other the barbers. These had been quarrelling among themselves until toward the end of the fifteenth century they entered into a friendly agreement to cease their rivalry and co-operate with each other. This agreement continued in force without any legal or formal action until 1511 when the combined efforts of the barbers and surgeons persuaded King Henry the Eighth to hand down a decree forbidding unqualified persons to practice medicine or surgery. Thus the surgeons became recognized in a semi-official way. In 1540 these two guilds were incorporated into a single organization, "The Barber Surgeons Company," and in the articles of incorporation the duties and privileges of surgeon and barber were laid down. The barbers were permitted to shave but were forbidden any surgery or bloodletting with the exception of pulling teeth, and the surgeons could not shave. With this incorporation the office of "Master of the Barber Surgeons Company" was created and Thomas Vicary was chosen to fill this high position.

Vicary was born in the last decade of the fifteenth century, the exact year being uncertain. He had studied medicine in Naples and Aleppo and in 1525 had been elected a member of the Surgeons of London. In 1528 he was made upper or first warden of the society and one of the surgeons to King Henry the Eighth. As time went on his influence with the Royal Family increased and he served successively as Sergeant of the Surgeons and Chief Surgeon to King Henry the Eighth. After Henry's death he retained the position with Edward the Fourth and in turn with Queen Mary and Queen Elizabeth until his death in 1561 or 1562.

Vicary received also the appointment as chief surgeon to St. Bartholomew's Hospital in 1548 after Henry the Eighth had given over its management to the City of London in the previous year, and this position he held until he was appointed Resident Surgical Governor of the Hospital and in 1552 was made "one of the assistants of this house for the terme of his lyffe." Thus Vicary became the most prominent surgeon in England. He was entrusted with the surgical organization of the greatest hospital in England and had three surgeons under him to carry out his ideas which were apparently good.

Though essentially a surgeon of civil life he states that in 1541 he took part in the expedition of King Charles the Fifth against Algiers and here apparently must have obtained his knowledge of the care of soldiers. He refers occasionally to the treatment of wounds of warfare and the diseases to which soldiers are liable. Military surgery does not dominate his writings as it does those of many of the surgeons who followed him.

Vicary really wrote little but as he was the first surgeon to write in English his works gained a great reputation and maintained their supremacy for many years. In 1548 he published an Anatomy in which he included also his surgery. In 1577 the surgeons of St. Bartholomew's Hospital, William Clowes, Will Beton, Richard Story, and Edward Bayly, published a new edition of this book under the title, "A Profitable Treatise of the Anatomie of Man's Body by Thomas Vicary." A further book published by these men which is credited to Vicary is "The Surgions Directorie,"[1] the edition of which the title page is reproduced here being that of 1651, which unless the date is a misprint appeared nearly a hundred years after Vicary's death.

The little book consists of Vicary's Anatomy, Surgery, and Pharmacopœia, and an article on English Bathes" written by D. Turner and published by W. Bremer. The part devoted to anatomy is practically a compilation of Galen and occupies Part 1, "Containing the Anatomie of Man's Body, compiled by T. V. Esquire, for the use and benefit of all unlearned Practitioners in the Art and Mystery of Chirurgene." It is interesting to note the title above Part 1 calls the work, "The Surgions Directorie or, An Exercise for Gentlewomen."

In surgery of wounds he insists on the removal of foreign bodies and though he recommends many forms of medicine and believes in them, he places as the prime requisite "the first thing that thou shalt doe to them is to wash them very cleane with wine, and then dry them well," etc. His cleanliness evidently accounted for his good results more than his medicines and ointments.

[1]Courtesy of Dr. LeRoy Crummer, Omaha, Nebraska.

# A REVIEW OF NEW BOOKS IN GYNECOLOGY AND OBSTETRICS

GEORGE GELLHORN, M.D., F.A.C.S., St. Louis

IN books, as with people, it is often the first impression that is of importance. With Ryall's book,[1] the first impression is one of unbounded admiration which only deepens as we continue to study it. We have here a tome of imposing size, devoted to operative cystoscopy. It contains 115 large plates with 670 original illustrations of which 528 are in color. These pictures are of surpassing excellence and convincingly true to life. The explanations of each plate are given in English, French, and German, which insures the book a universal circulation. The author who is the Founder of, and Senior Surgeon to, All Saints Hospital for Genito-urinary Diseases in London, presents, in the first 46 pages, a brief discussion of the conditions which are demonstrated in his marvelous collection of pictures.

It is true that the work here exhibited was done altogether on men; but once the cystoscope has passed into the bladder, the picture seen is the same of whatever sex is the patient. The gynecologist may, therefore be permitted to express his great appreciation of the service the author has rendered the reading public by preparing this volume which, as far as any book can, may substitute for a clinical course on the living. We gynecologists may not be interested in the introductory remarks on anæsthesia and technique of cystoscopy through the male urethra, nor in the discussion on prostatic diseases, their diagnosis and treatment; but we are vitally interested in the chapters on ureter and bladder, and we are grateful to the author for representing the successive stages of treatment in particular cases of typical character, beginning with the first cystoscopy and ending with the final one.

This is not the place to dilate on the self-evident truth that the modern gynecologist must be familiar with the cystoscope. It is sufficient to state that in his work the gynecologist will be immensely benefited by Ryall's atlas, for in consulting this volume, he will soon find an explanatory picture of what he may have seen through his instrument. If I may express a wish, it is this: that the author may include in a later edition (or publish in an appendix) those pictures which are more typical of female patients; for instance, the common trigonitis of women, the progress of cancer from the uterus into the bladder, the cystoscopic appearance in retroflexion of the pregnant uterus or fibroids, or such unusual findings as the perforation of a pyosalpinx into the bladder, or the picture of a transplanted ureter.

Much credit is also due the publisher for making this English work more easily accessible in this country.

[1] OPERATIVE CYSTOSCOPY. By E. Canny Ryall, F.R.C.S. St. Louis: C. V. Mosby Co., 1925.

A SHORT time ago the papers brought the news of the death of Professor Karl Franz, of Berlin. As he and I were classmates in medical school, I have always watched, with interest, his meteoric career which led him, a man of barely forty, to one of the most important chairs of gynecology and obstetrics in Germany. He was a splendid teacher, an independent thinker, and a superb surgeon; and in his book[2] which appeared only a few months ago, he has left a very remarkable synopsis of his life's work.

He called this book "Gynecological Operations." He might well have called it "My Gynecological Operations," not only because it is based upon the impressively large material of 6,114 operative cases, but because it deals only with the methods sponsored by him personally. This personal note runs, like a red thread, throughout the book. It manifests itself in the very preface. "I often read," he says, "on the shingles of physicians the appellation 'surgeon and gynecologist,' and I am amazed how many there seem to be who think that they can master both these large fields. I myself find it difficult enough to keep abreast in gynecology alone. The fault may be with me. I doubt not that there are men so generously endowed that they can be good surgeons as well as good gynecologists, but I wonder whether there are many such." To be a good gynecologist requires more, much more, than mere technique, and yet, a book on operative gynecology can describe and teach only the purely technical side of operative treatment so as to release operations of potential dangers and render them truly beneficial procedures.

There is, therefore, first a detailed discussion on the prevention of infection, and this includes his method of disinfection, the installation of his operating room, the general operative technique, his pre-operative and postoperative routine together with the management of the various postoperative complications. In the question of narcosis, spinal anæsthesia is the method of choice; no less than 6,015 patients were operated upon in this manner. The mortality (9 cases) and morbidity are frankly discussed. While admitting its dangers and complications, the author concludes that spinal anæsthesia possesses signal advantages over inhalation narcosis.

For laparotomies, the Pfannenstiel incision is given decided preference. Of all the operative procedures for retroflexion—I believe, about 130 different methods exist in literature—only the Alexander-Adams operation is described and depicted; occasionally, an "internal Alexander" is

[2] GYNAEKOLOGISCHE OPERATIONEN. By Karl Franz. Berlin: Julius Springer, 1925.

performed. Most of the operations for relaxed pelvic floor were combined with this shortening of the round ligaments because Franz, to my mind very justly, regarded the proper position of the uterus as the best protection against recurrences. Hysterectomy or the interposition operation for prolapse does not meet with his approval. The Kjelland prolapse operation appeared to him far better; yet, his results are by no means convincing. In fibroids, supravaginal amputation is preferable to total hysterectomy, because, in the author's opinion, later malignancy in the cervical stump is too infrequent to be of practical importance. Radiation therapy is not often advisable. In carcinoma, the abdominal radical operation gives the best results. Franz has performed 800 such operations with an immediate mortality of 14.1 per cent, and 40 per cent cures after 5 years. I may add here, parenthetically, from personal observation, that in these operations the daring and skill of Franz showed itself to best advantage.

It is not surprising that to him operation seemed superior to X-ray or radium. Transperitoneal cervical cæsarean section was performed 300 times, with only 4 deaths.

All these, and other operations which were not mentioned in this survey, are described in detail, and their results and failures discussed with equal frankness. The statistical investigations are most painstaking and seem to me particularly valuable because they bear the stamp of utter sincerity.

All operative procedures are profusely illustrated, for the most part, in natural colors and reproduced in such a way that "nothing was added and nothing was taken away," that is, the plates were not retouched. Impressive though these pictures are at first sight, the wealth of detail is so bewildering that, after all, they appear unnatural, and, in fact, black and white diagrams had to be added to make the illustrations intelligible. This attempt at reproducing operations in natural colors is not altogether novel. As far as I know, Hadden, of California, in his *Gynecology of Obstetrics* (1915) had resorted to the same process before but he, too, had to fall back on interpretative diagrams. The technique of color photography in surgery is, after all, not yet perfect.

I realize that this review, extensive though it is, by no means covers the contents of the book. Much had to be omitted. The charm of diction could not be reproduced which gives the impression that the author was speaking to you direct. Nor could the many controversial points be taken up in which the book abounds.

This work on gynecology, let it be remembered, is from beginning to end the subjective expression of a single individual; but this individual is, or was, a man whose opinion and experience commands respect, even after his death. It is, therefore, so intensely stimulating that it, probably, will soon be found in the library of every progressive gynecologist.

A number of new installments of *Biology and Pathology of Woman*,[1] edited by Halban and Seitz, have put in appearance in the past few months. It has been my privilege to call attention to the essays embodied in this reference work in previous reviews. Today, for lack of space, I shall have to content myself with little more than an enumeration of the various new contributions.

Schade writes on the biochemistry of pregnancy, labor, and puerperium, a subject which is full of new and interesting information to the clinician.

Kehrer deals, in an extensive monograph, with the physiology of pregnancy. During this epoch there occur in the organism changes which have no parallel in nature. Yet, the organs of the pregnant woman carry on their functions with a marvelous precision without, normally, ever disturbing the delicate equilibrium of the body. To understand fully this amazing mechanism it is necessary to delve, beyond the field of obstetrics proper, into problems of internal medicine, biochemistry, pathological anatomy, constitution, and even eugenics. It is from such wider angles that the author presents his dissertation.

The next article, by Eufinger, on the diagnosis of pregnancy goes, in part, over the same ground which was covered in Kehrer's contribution. In a large reference work, such repetitions are, however, unavoidable and not objectionable.

The thesis by Guggisberg on labor pains contains numerous original experiments. The various theories of the cause of uterine contractions are presented and their normal and abnormal behavior described. The article concludes with a detailed discussion of the action of quinine, pituitrin, and ergot.

Mayer offers an exhaustive study of ovarian tumors. His paper is based on 682 such tumors which were observed in his clinic. An enormous amount of literature has been consulted.

Fueth discusses the various mechanical, traumatic, chemical, and thermic injuries of the genitals. Vaginal and intra-uterine pessaries are the most important of the foreign bodies enumerated. The rôle of accidents in gynecology and obstetrics is also taken up.

The relations between the female genitals and other organs and systems are dealt with in several contributions. Thus, Novak discusses the relations with the eye, Jagič those with the circulatory system. The latter author adds, together with Hickl, a paper on the effect of the various anæmias. Linzenmeier presents an authoritative thesis on the sedimentation test; and Eckelt evaluates the relations with the liver and the kidneys.

A volume of almost 700 pages is devoted to the normal and pathological behavior of placenta and amniotic fluid (Hinselmann), and to the pathology of decidua, membranes, and umbilical cord (Schmidt).

[1] Biologie und Pathologie des Weibes. Ein Handbuch der Frauenheilkunde und Geburtshilfe. Edited by Josef Halban, Vienna, and Ludwig Seitz, Frankfort. Berlin and Vienna: Urban & Schwarzenberg, 1925 and 1926.

An article by Baisch deals with the diseases of the peritoneum. In the same installment is found the contribution by von Jaschke on the female breast. I cannot refrain from calling particular attention to this monograph which is illustrated with truly magnificent colored plates. Our particular problems are here more satisfactorily considered than is usually the case in surgical works on this subject.

Nuernberger presents a chapter on the postmature child, and, in collaboration with Heynemann, a very extensive dissertation on miscarriage and premature birth.

The anatomy and statics of the bony pelvis are described by Krukenberg; while Martin dilates on the contracted pelvis. The same author presents, in another installment, the diseases of the pelvic cellular tissue and embodies therein his well known researches of the pelvic fascia.

The presentation by Martius of dystocia caused by anomalies of the passenger deserves mention.

The chapter on syphilis is written by Matzenauer. The author who is a recognized authority on syphilis, has here collected a wealth of interesting and important material on a subject to which the gynecological world has not yet given sufficient attention. In the controversy on paternal or maternal transmission of syphilis, the author emphatically declares that Colles' law prevails without a single exception. I mention this, not only because I absolutely agree with him, but because in our own obstetrical literature an attempt is made every now and then to establish such exceptions. With all my great appreciation and admiration of this contribution, I yet feel that the author, being a dermatologist, could not be in direct and close touch with all the problems which confront the gynecologist in the question of syphilis.

Two installments of altogether 500 pages contain Winter's monograph on operative obstetrics. The clearness of this eminent teacher is again demonstrated in his latest work.

I regret exceedingly that I cannot go into further details, much as all these painstaking essays deserve it. As mentioned in previous reviews, I shall try to present a more adequate appraisal of this monumental work when all installments have appeared.

IN the writing of the sixth edition of Eden's *Obstetrics*,[1] the authors have displayed discrete consideration for the overwrought student of medicine by reducing the subject matter of the text by some forty pages. There has been much pruning of the previous edition which permits of the addition of 24 new illustrations and much subject matter that is in part new and in part an evaluation of long tried methods of procedure.

Changes in metabolism during pregnancy are concisely presented with no effort on the part of the authors to dwell upon the speculative phases of the subject.

In rewriting the sections dealing with the toxæmias of pregnancy, effort has been made to weigh in the balance the medical and surgical means of treatment. "Only in the earliest stages can the disease be controlled with any certainty," say the authors and then follows a plea for the recognition of the pre-eclamptic stage and the installation of therapeutic measures which may avert the convulsions.

All in all, the text is commended as an admirable guide to students. The subject matter is presented in a concise manner yet omitting no essential details. The illustrations are well executed.

PALMER FINDLEY.

DAS presents a text of 480 pages for the needs of medical students in India.[2] It would scarcely be considered of sufficient scope to meet the demands of intructors in obstetrics in America. However, it may be fairly stated that it contains all that can be assimilated by the average medical student. It is in no sense a reference book, but would serve admirably as an introduction to the subject of obstetrics. The book is precise and thorough and presents the essentials of obstetrics in a most acceptable manner. PALMER FINDLEY.

IN this little volume[3] Buchanan presents the mechanism of labor in a most ingenious manner. It is an effort toward simplification and as such is to be commended to the student of obstetrics. There are 80 pages in all with numerous photographs of models intended to demonstrate the pivot points. In addition to the photographs of models are many ingenious drawings which serve to elucidate the text. Instructors in obstetrics would do well to peruse these pages. PALMER FINDLEY.

THE debatable questions which Paramor endeavors to clarify are: what are the normal supports of the pelvic viscera and what is the nature of the prolapse. This work of some 400 pages[4] is a historical survey of "prolapse" and of its operative treatment to the end of the last century. It deals with the inception of plastic prodecures; with the early elaboration of vaginal plastic operations and extirpation of the uterus; with early perineorrhaphy; with the amputation of the cervix coupled with perineorrhaphy; with the conception of prolapse as a hernia and ends with Kelly's conception of prolapse. PALMER FINDLEY.

"TAKING stock" in medicine is as necessary a procedure as in business. Judiciously to appraise the technical knowledge that is constantly

[1] A TEXTBOOK ON OBSTETRICS. By Thomas Watts Eden, M.D., C.M. (Edin.), F.R.C.S., F.R.C.P., and Eardley Holland, M.D., B.S. Lond.), F.R.C.P., F.R.C.S. 6th ed. New York: The Macmillan Company, 1925.

[2] A TEXTBOOK ON MIDWIFERY FOR MEDICAL SCHOOLS AND COLLEGES IN INDIA. By Kedarnath Das, C.I.E., M.D. 2d ed. Calcutta: Thacker, Spink & Co., 1926.

[3] MIDWIFERY MECHANICS. By Lieut.-Colonel Andrew Buchanan (Retd.), I.M.S. London and New York: Humphrey Milford, Oxford University Press, 1926.

[4] THE STATICS OF THE FEMALE PELVIC VISCERA. By R. H. Paramor, M.P. (Lond), F.R.C.S. (Eng.). London: H. H. Lewis & Co., Ltd., 1925.

appearing in medical literature is no easy task and it is for this reason that the general practitioner welcomes such a work as that of Bourne[1] which has for its object the setting forth of the new matter in Gynecology and Obstetrics and this in a concise form. The text is largely an expression of opinion on the many theories and practices rather than a detailed description of new methods and discoveries.

The chapters on antenatal care, prognosis and treatment of eclampsia, antepartum hæmorrhage, puerperal infection, the ductless glands, the use of the X-rays in obstetrics, carcinoma of the cervix and electrotherapeutics in gynecology are particularly commended. PALMER FINDLEY.

WE are indebted to Dr. M. G. Seelig for the introduction of the American edition of the admirable work on the breast by Duncan Fitzwilliams.[2] The text of 440 pages is profusely illustrated and is replete with case citations. It is written in the customary narrative style of the English clinician and is an attestation of the author's powers of observation and clear thinking. The chapter on congenital abnormalities deserves special mention in that it is rich in unique illustrations and case records.

More than half of the text is devoted to a discussion of tumors of the breast. The author finds great difficulty in classifying cysts of the breast because of the many cysts of apparently different nature and the want of any authentic knowledge of their origin. Much space is given to an elucidation of simple or benign tumors which ofttimes closely resemble carcinoma clinically.

Our interest centers in the chapters on carcinoma of the breast. Here we find the author paying his respects in no uncertain words to the quasi-scientific men and to the lay press who on frequent occasions are wont to announce that "they are convinced that we are just upon the eve of discovering the cause and the cure for cancer," and he adds that "it must regretfully be owned that we are as much in the dark about the essentials of this disease as ever we were."

Referring to the surgical treatment of carcinoma of the breast, the author avers that "the gradual extension of the magnitude of the operation has been disappointing in not bringing to the sufferers the compensating freedom from the return of the disease." And adding—"the operation is three times the extent and three times as severe as it used to be, but the results have not improved in proportion; they have improved, it is true, but some of that improvement is due to earlier diagnosis. On early *diagnosis* depends the future of our patients." Disappointment is expressed in the after-treatment with X-rays. No permanent benefit has been derived from the X-rays in cases that were doubtful at the time of operation. Yet much good is accomplished by the X-rays in relief from pain, the closing of ulcerated surfaces and then in the mental effect of such a form of treatment. "Early removal before malignant characteristics have manifested themselves is the ideal which must be impressed by the medical school upon its young graduates if improvement in prognosis is to be looked for."

This admirable work is deserving of a place in the library of every surgeon and general practitioner.

PALMER FINDLEY.

SEXUAL and reproductive processes as exhibited in the higher animals and man comprise the subject matter of Marshall's volume.[3] While the author calls his contribution "An Introduction to Sexual Physiology" there is vastly more material in the text than is to be found in textbooks on the general subject of physiology. The work is written for biological, medical and agricultural students, but it cannot fail to interest all who are concerned with the problems of sexual physiology.

In the opening chapter we find a discussion of sexual reproduction; of sexual reproduction among multicellular animals and of seasons of sexual activity. Then follow in successive chapters a brief presentation of the anatomy of the reproductive organs in the high animals; a treatise on the mammalian sexual cycle in which the physiology of menstruation in higher animals and man is discussed in a manner that throws much light upon many unsolved problems. The subjects of parturition, puerperium, and lactation are concisely presented and from this point on to the end of the text the author deals in a most ingenious and entertaining manner with the subjects of internal secretions of the organs of reproduction. The effects of castration upon the hen, duck, cock, and ram are discussed and illustrated. In this connection it is of interest to note the conclusion of the author that "as long as the corpus luteum dominates the ovarian metabolism, the normal ovarian secretion, which promotes rhythmic uterine contractions, is inhibited; but that when the corpus has reached a certain stage of involution, the ovarian endocrine mechanism, which probably works partly through the intermediation of the pituitary, resumes its activity, and the tolerance of the uterus for the fetus no longer continues, so that the uterus, responding more readily to internal stimuli from the developed fetus contracts strongly and birth is the result."

The text ends with a discussion of heredity and sex with special reference to inheritance of acquired characters; to maternal impressions, to the determination of sex, and finally with a general survey of the subject of fertility. PALMER FINDLEY

[1] RECENT ADVANCES IN OBSTETRICS AND GYNECOLOGY. By Aleck W. Bourne, B.A., M.B., F.R.C.S. (Eng.). Philadelphia: P. Blakiston's Son & Co., 1926.

[2] ON THE BREAST. By Duncan C. L. Fitzwilliams, C.M.G., F.R.C.S. St. Louis: C. V. Mosby Co., 1924.

[3] AN INTRODUCTION TO SEXUAL PHYSIOLOGY; FOR BIOLOGICAL, MEDICAL AND AGRICULTURAL STUDENTS. By F. H. A. Marshall, F.R.S. New York: Longman, Green and Co., 1925.

# CORRESPONDENCE

## THE BELL-BEUTTNER OPERATION WITH OVARIAN CONSERVATION OR GRAFTING

*To the Editor:* In relation to the Bell-Beuttner operation as described in SURGERY, GYNECOLOGY AND OBSTETRICS in January, 1926, I would draw attention to the fact that in 1908 I published an article in which I described the principles of this operation, and while the method has been modified in some detail by various surgeons, the principles remain the same. For this reason I believe that the operation should be known as the Beuttner operation and should not be designated with the names of the surgeons who have modified it in some detail.

PROF. DR. BEUTTNER.

Geneva, Switzerland.

## BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

TRANSACTIONS OF THE FIFTH ANNUAL CONFERENCE OF STATE SANITARY ENGINEERS, held at Cincinnati, Ohio, May 26, 27 and 28, 1924. Washington: Government Printing Office, 1925.

THE COURSE OF CANCER MORTALITY IN THE TEN ORIGINAL REGISTRATION STATES FOR THE 21-YEAR PERIOD, 1900–1920. By Surgeon J. W. Schereschewsky. Prepared by Direction of the Surgeon General. Washington: Government Printing Office, 1925.

MENTAL HYGIENE WITH SPECIAL REFERENCE TO THE MIGRATION OF PEOPLE. By Walter L. Treadway. Prepared by Direction of the Surgeon General. Washington: Government Printing Office, 1925.

A STUDY OF THE TOP MINNOW, GAMBUSIA HOLBROOKI, IN ITS RELATION TO MOSQUITO CONTROL. By Samuel F. Hildebrand. Prepared by Direction of the Surgeon General. Washington: Government Printing Office, 1925.

INTERNATIONAL CLINIC; A QUARTERLY OF ILLUSTRATED CLINICAL LECTURES AND ESPECIALLY PREPARED ORIGINAL ARTICLES. vol. iii. 36th series, 1926. Philadelphia: J. B. Lippincott Company, 1926. Edited by Henry W. Cattell, A.M., M.D., with the collaboration of others.

THE OPHTHALMIC YEAR BOOK. vol. xxii. Containing Bibliographies, Digests, and Indexes of the Literature of Ophthalmology for the year 1925. Edited by William H. Crisp with collaboration of others. Chicago: Ophthalmic Publishing Company, 1926.

PRACTICAL SURGERY OF THE JOSEPH PRICE HOSPITAL. By James William Kennedy, M.D., F.A.C.S. Philadelphia: F. A. Davis Company, 1926.

OUR DOCTORS; A NOVEL OF TODAY. By Maurice Duplay. Translation and preface by Joseph Collins. New York: Harper & Brothers, 1926.

THE SURGICAL TREATMENT OF GOITER. By Willard Bartlett, A.B., A.M., M.D., D.Sc., F.A.C.S. Foreword by Charles Mayo. St. Louis: The C. V. Mosby Company, 1926.

HANDATLAS DER CYSTOSKOPIE. By Dr. Med. Otto Kneise. Leipzig: Georg Thieme, 1926.

THE CARRIER PROBLEM. By K. C. Paul, M.B.B.S. with foreword by David Nabarro, M.D., F.R.C.P. (Lond.). New York: Oxford Medical Press, 1926.

THE ABDOMEN IN LABOUR; BEING A GENERAL PRACTITIONER'S CLINICAL STUDY OF THE PARTURIENT ABDOMEN. By Norman Porritt, M.R.C.S., L.R.C.P. (Lond.). New York: Oxford University Press, 1926.

THE HEART. By Alexander George Gibson, D.M., F.R.C.P. (Lond.). Oxford University Press, 1926. New York.

OBSTETRICS. By John S. Fairbairn, M.A., B.M., B.Ch. (Oxon.), F.R.C.P. (Lond.), F.R.C.S. (Eng.). New York: Oxford University Press, 1926.

HISTOLOGICAL TECHNIQUE; FOR NORMAL TISSUES, MORBID CHANGES AND THE IDENTIFICATION OF PARASITES. By H. M. Carleton, M.S., B.Sc., D.Phil. New York: Oxford University Press, 1926.

OBESITY. By Leonard Williams, M.D. New York: Oxford University Press, 1926.

HUNTER TOD'S DISEASES OF THE EAR. Revised and largely re-written by George C. Cathcart, M.A., M.D., 2d ed. New York: Oxford University Press, 1926.

THE BELOVED PHYSICIAN; SIR JAMES MACKENZIE; A BIOGRAPHY. By R. Macnair Wilson. New York: The Macmillan Company, 1926.

THROMBO-PHLÉBITE; INFECTIEUSE; DU SINUS CAVERNEUX; ET LÉSIONS ASSOCIÉES SEPTIQUES ET TRAUMATIQUES DES SINUS VEINEUX DE LA BASE. By Wells P. Eagleton, M.D. Paris: Masson et Cie, 1926.

A DESCRIPTIVE ATLAS OF VISCERAL RADIOGRAMS. By A. P. Bertwistle, M.B., Ch.B., F.R.C.S.(Ed.), and E. W. H. Shenton, M.R.C.S., L.R.C.P. Introduction to American edition by M. G. Seelig, M.D., F.A.C.S.

PRINCIPLES AND PRACTICE OF CHEMOTHERAPY; WITH SPECIAL REFERENCE TO THE SPECIFIC AND GENERAL TREATMENT OF SYPHILIS. By John A. Kolmer, M.D., Dr. P.H., D.Sc. (Hon.). Philadelphia: W. B. Saunders, 1926.

A TEXT-BOOK OF SURGICAL HANDICRAFT; FOR THE USE OF MEDICAL STUDENTS. 2d ed. By J. Renfrew White, Ch.M. (N.Z.), F.A.C.S. New York: The Macmillan Company, 1926.

# AMERICAN COLLEGE OF SURGEONS

## REPORT OF THE SIXTEENTH ANNUAL MEETING OF THE CLINICAL CONGRESS OF THE AMERICAN COLLEGE OF SURGEONS, MONTREAL, CANADA

THE sixteenth annual Clinical Congress of the American College of Surgeons opened in Montreal on Monday morning, October 25, 1926, with headquarters at the Windsor Hotel. The accommodations for registration, meetings, and exhibits were particularly satisfactory because of the fact that they were all on the one floor and within easy access.

The first session was called to order at 10:00 a.m. in Windsor Hall, with Dr. Rudolph Matas, of New Orleans, President of the College, in the chair. The opening addresses were delivered by Sir Arthur Currie, G.C.M.G., K.C.B., LL.D., Montreal, Principal of McGill University; Dr. A. K. Haywood, Superintendent of the Montreal General Hospital; and Sir Lomer Gouin, former Premier of the Province of Quebec. The morning program consisted of a presentation of hospital subjects by Dr. Rudolph Matas; Professor David P. D. Wilkie, O.B.E., Edinburgh, Scotland; Dr. L. E. Barnett, C.M.G., F.R.C.S., Dunedin, New Zealand; Dr. D. Sclater Lewis, Montreal, representing the American College of Physicians; and Edward A. Fitz-Patrick, Ph.D., Dean of the Graduate School, Marquette University, Milwaukee. Dr. Franklin H. Martin, Director General of the American College of Surgeons, presented the official report on Hospital Standardization for the year 1926 with the list of approved hospitals.

The afternoon session began at 2:00 o'clock in Windsor Hall with Dr. A. K. Haywood presiding. This meeting attracted a great deal of attention as it was a joint conference on hospitals and nursing. The program was opened by Dr. W. W. Chipman, the President-elect of the College of Surgeons, who spoke on "Nursing as a Service Profession." The program was composed of addresses by both doctors and nurses, leaders in their various fields of work, all of whom had given careful study to the problems of nursing and who represented outstanding organizations.

At the Monday night meeting in Windsor Hall, the following visiting guests were presented by the Director General: Archibald Young, Esq., M.B., C.M., F.R.F.P.S., Glasgow, Scotland; Professor Roberto Alessandri, Rome, Italy; W. Sampson-Handley, M.S., F.R.C.S., London, England; Sir Ewen J. Maclean, F.R.C.P. (Lond.), F.R.S. (Edin.), Cardiff, Wales; John Fraser, M.D., F.R.C.S. (Edin.), Edinburgh, Scotland; L. E. Barnett, C.M.G., F.R.C.S., Dunedin, New Zealand; Professor D. P. D. Wilkie, Edinburgh, Scotland; Rudecindo de la Fuente, M.D., Valparaiso, Chile; Luis de Rezende Puech, M.D., São Paulo, Brazil; Ricardo Palma, M.D., Lima, Peru. The address of welcome was delivered by Dr. A. T. Bazin, of Montreal, Chairman of the Local Committee on Arrangements. General Sir Arthur Currie presented the compliments of McGill University and added further to the welcome of our guests. The address of the retiring President, Dr. Rudolph Matas, of New Orleans, was followed by the inauguration of the new President, Dr. Walter W. Chipman, of Montreal. The John B. Murphy Oration in Surgery was delivered by Archibald Young, M.B., C.M., F.R.F.P.S., Glasgow, Scotland, who spoke upon the subject of "Sir William Macewen and the Glasgow School of Surgery."

On Tuesday morning, October 26, the clinics began in the various hospitals of the city and were well attended. During the morning, beginning at 9:30 o'clock, a Hospital Conference was conducted under the Chairmanship of the new President in the Ladies' Ordinary. This conference was crowded to capacity and many exceedingly instructive and interesting points relative to hospitalization were introduced for discussion. At 9:30 a.m. the Section on the Eye, Ear, Nose and Throat convened in Windsor Hall, At 10:00 a.m. on Tuesday, the Board of Regents met in Salon A and continued in session throughout the morning and for a large part of the afternoon. At 2:00 p.m. the Section on General Surgery, Gynecology, Obstetrics, Urology and Orthopedics convened in Windsor Hall, while the Hospital session continued in the Ladies' Ordinary.

The program of the Tuesday night meeting began at 8:00 o'clock in Windsor Hall, with

Dr. Charles F. Nassau, of Philadelphia, Vice-President of the College, in the chair. The program opened with an address on "Tumors in Bones of Thyroid and Parathyroid Type, without Lesion of the Thyroid Gland" by Professor Roberto Alessandri, of Rome. Professor Alessandri's address was followed by interesting presentations from Dr. W. J. Mayo, of Rochester, who spoke on "The Cancer Problem"; W. Sampson-Handley, M.S., F.R.C.S., London, England, on "Progress in the Treatment of Breast Cancer"; and Dr. Robert B. Greenough, of Boston, who summarized the report of the Committee on the Treatment of Malignant Diseases with Radium and X-ray, of which he is the Chairman.

Hospital clinics began as usual on Wednesday morning, and the sessions at the hotel opened at 9:30 with a symposium on "The Standardization of Ophthalmological and Oto-Laryngological Departments in General Hospitals." Dr. Herbert S. Birkett, of Montreal, occupied the chair. The purpose of the conference was outlined by Dr. Malcolm T. MacEachern, Associate Director of the College in charge of Hospital Standardization.

The Section on General Surgery, Gynecology, Obstetrics, Urology, and Orthopedics convened at St. Sulpice Library on St. Denis Street at 2:00 p.m. when an interesting program was presented by Dr. George David Stewart, of New York, Professor D. P. D. Wilkie, Edinburgh, Scotland, Dr. Hugh H. Young, Baltimore, and Dr. John Osborn Polak, Brooklyn. The discussion was conducted by Drs. Eugene St. Jacques, and L. de L. Harwood, of Montreal.

On Wednesday afternoon demonstrations and clinics in Hospital Administration were conducted at the following hospitals: Montreal General—Central Division, Notre Dame, St. Justine, Alexandra, and Montreal General—Western Division.

The Wednesday evening program was held in Windsor Hall and was opened by Dr. Evarts A. Graham, St. Louis, who spoke on "Recent Additions to Our Knowledge of the Gall Bladder." This was followed by a discussion led by Dr. Edward Archibald and Dr. E. M. Eberts, of Montreal. Dr. Gordon New, of the Mayo Clinic, Rochester, presented the subject of "Plastic Surgery of the Face," and was followed by Dr. John Staige Davis, of Baltimore, on the "Transplantation of Skin" and a discussion opened by Dr. Ernest Fulton Risdon, of Toronto. A symposium on "Plastic Surgery of the Hand" was presented by Drs. Sumner L. Koch and Allen B. Kanavel, of Chicago; Arthur Steindler, of Iowa City; Henry H. M. Lyle, of New York; and Sterling Bunnell, of San Francisco. The closing discussion was conducted by Dr. Laurie H. McKim, of Montreal.

The Section on Surgery of the Eye, Ear, Nose and Throat convened at 9:30 a.m. on Thursday under the Chairmanship of Dr. Paul Bousquet, of Montreal, and an interesting program was presented on subjects pertaining to these specialties.

At 10:00 a.m., Dr. M. T. MacEachern, of Chicago, Associate Director of the College, presented an illustrated address outlining his recent visit to Australia and New Zealand, and in the afternoon the hospital representatives attended demonstrations and clinics in Hospital Administration at the following institutions: Royal Victoria, Shriners, Hotel Dieu, Hospital Français, and Children's Memorial.

The annual meeting of the Fellows and Governors of the College took place on Thursday afternoon at 2:30 in Windsor Hall, the President, Dr. W. W. Chipman, in the chair. Dr. James T. Case, of Battle Creek, Michigan, presented the report of the Nominating Committee. The following were elected to office: Dr. George David Stewart, of New York City, President; Vice-Presidents, Dr. Truman Brophy, of Chicago, and Col. Frank Hamilton Mewburn, of Edmonton, Alberta; Regents, term expiring 1929—Drs. A. T. Bazin, Montreal; Irvin Abell, Louisville; C. Jeff Miller, New Orleans; Franklin H. Martin, Chicago; and Surgeon General Merritte W. Ireland, Washington, D. C. The election of officers was followed by the presentation of the annual report of the Director General, the financial report of the Treasurer, Dr. Frederic A. Besley, and the reports of the various departments of the College. The annual business meeting was followed by a short scientific session with addresses by Dr. Robert Greenough, Boston; W. Sampson-Handley, M.S., F.R.C.S., of London, England; and Professor John Fraser, of Edinburgh, Scotland.

The evening session on Thursday was opened with addresses by Dr. John Fraser of Edinburgh, on "The Involuntary Nervous System in Relation to Abdominal Disease," and L. E. Barnett, C.M.G., F.R.C.S., Dunedin, New Zealand, on "Recent Advances in Our Knowledge of Hydatid Disease." A symposium on "Sterility in Men and Women" was conducted by Drs. Edward L. Keyes, New York; Robert T. Frank, New York; and John Osborn Polak, Brooklyn; and discussed by Drs. Frank S. Patch and H. M. Little, of Montreal.

Friday, October 29, the closing day of the Congress, one of the busiest of all, opened with hospital clinics and a session of the Eye, Ear, Nose and Throat Department at 9:30 a.m. under the direc-

tion of Dr. H. D. Hamilton, of Montreal. At 10:00 a.m. the new candidates for Fellowship in the College assembled in the Prince of Wales Salon to receive their final instructions for the Convocation ceremony. They were addressed by the Director General and the President-elect, Dr. George David Stewart, of New York.

At 11:00 o'clock on Friday morning a special session of the Board of Regents was held in Salon A to meet and discuss with Mr. Will Hays, President of the Motion Picture Producers and Distributors of America, Inc., the use of motion pictures in the teaching of medicine, surgery, public health, and allied sciences. Mr. Hays made a special trip from New York for the purpose of meeting the Regents and this session will long be remembered by those who had the good fortune to be present. Everyone was enthusiastic over the possibilities of developing the motion picture field for medical education, and definite action was undertaken. At 4:00 o'clock, during the symposium on fractures, conducted by the Chairman of the Committee on the treatment of Fractures, Dr. Charles L. Scudder, of Boston, in Windsor Hall, Mr. Hays addressed the Fellows of the College and definitely announced that he, himself, and the Motion Picture Producers and Distributors of America, Inc., were solidly behind the movement instituted by the College of Surgeons for the development and use of motion pictures in medical teaching both for lay and professional use. Mr. Hays was given an enthusiastic reception and a standing vote of thanks by the large audience present.

At 3:00 o'clock on Friday, the Montreal Maternity Pavilion of the Royal Victoria Hospital was opened and interesting addresses were presented by Drs. W. W. Chipman, Montreal; J. Whitridge Williams, Baltimore; and William P. Graves, Boston.

The annual Convocation of the College took place on Friday night at 8:00 o'clock in Windsor Hall. There have been no more picturesque events in the history of the College, the new Fellows standing in their places in caps and gowns, the procession headed by an officer of the Duke of York's Royal Hussars in full uniform bearing the Mace, followed immediately by the President, the Director General, and Regents of the College, the large audience standing at attention, while the orchestra played the British National Anthem, presented a setting which will long be remembered. The Invocation by the Very Reverend Arthur Carlisle, Dean of Montreal, Rector of Christ Church Cathedral, was followed by the conferring of Honorary Fellowships upon Archibald Young, Esq., M.B., C.M., F.R.F.P.S., Glasgow; Professor Roberto Alessandri, Rome; W. Sampson-Handley, M.S., F.R.C.S., London; Sir Ewen J. Maclean, F.R.C.P. (Lond.), F.R.S. (Edin.), Cardiff, Wales; Professor John Fraser, M.D., F.R.C.S. (Edin.), Edinburgh; L. E. Barnett, C.M.G., F.R.C.S., Dunedin, New Zealand; and Professor D. P. D. Wilkie, O.B.E., Edinburgh. The Presidential Address was delivered by Dr. W. W. Chipman, who chose for his subject, "Lord Lister." The Fellowship Address was delivered by Sir Ewen J. Maclean, who spoke on "Some Observations on the Objects of the College." The Fourteenth Convocation of the American College of Surgeons closed with the American National Anthem and a reception of the new Fellows by the Board of Regents and guests.

The most outstanding and far-reaching events of the week were (1) the adoption by the Board of Regents of the report of the Committee on Traumatic Surgery which embodied a suggested Minimum Standard for this particular line of work; (2) the announcement of the list of approved hospitals for 1926, and (3) the initiation of the movement for the supervision of motion pictures for educational purposes in medicine, surgery, public health, and allied sciences. These three events will mark the Montreal Congress of 1926 as one of the most important in the history of the College.

No report of this Congress would be complete without an expression of appreciation of the cooperation and interest of the press of Montreal. The published reports and editorials were complete, accurate, and ethical in every way.

Everyone was delighted with the Congress and deeply grateful for the excellent clinics and sessions which were presented and, as well, for the kindly consideration and entertainment which they received in the City of Montreal. Those who attended this Congress will long look back with pleasure and profit to the pleasant days from the 25th to the 29th of October, 1926. Especially do we owe our thanks to the President, Dr. W. W. Chipman, and to the Chairman of the Local Committee on Arrangements, Dr. A. T. Bazin, and to their confrères in Montreal who worked so hard to make this meeting a great success, and whose efforts were so fully rewarded.

# MOTION PICTURE FILMS FOR THE TEACHING OF MEDICINE, SURGERY, AND ALLIED SCIENCES

THE advancements in moving picture production within the last ten years have been exceedingly remarkable. Through improvements in lighting, microphotography, fine lenses, ultraspeed, animation, analysis of motion, etc., it is now possible to utilize the film for purposes of demonstration in ways heretofore unthought of. The vitaphone, phonafilm, and other methods of synchronization will permit the production of film in which the voice of the operator or teacher may be heard in explanation of the subject matter. It is the object of the American College of Surgeons to see that films true to facts and fundamental principles, meeting the ethical standards of recognized medicine, are made available for teaching purposes, and that the films shall depict the operation or the subject and not the operator. The College will also endeavor to point out what subjects are best suited for motion picture illustration and will lend its approval to films of a high-class nature, valuable for medical teaching.

At a meeting of the Board of Regents of the American College of Surgeons held in Washington in March, 1925, a Committee was appointed to consider the development and approval of moving picture films in the teaching of medicine, surgery, and allied sciences. This Committee consisted of Dr. J. Bentley Squier, Chairman; Dr. W. W. Chipman, of Montreal; Dr. Franklin H. Martin; Dr. John G. Clark, of Philadelphia; and Dr. Allan Craig. The Committee met in New York with Mr. Will Hays, President of the Motion Picture Producers and Distributors of America, Inc. After conferences with Mr. Hays and careful consideration of the whole subject, a report was presented to the Board of Regents at a special meeting held at the Windsor Hotel, Montreal, on October 29, 1926. Mr. Hays was present at this meeting and assured the Regents of the entire co-operation and support of the Motion Picture Producers and Distributors of America, Inc. The report presented read as follows:

*To the members of the Board of Regents of the American College of Surgeons:* Your Committee on the approval and development of motion picture films for purposes of medical education begs to present the following report and recommendation: For the purposes of this committee the term "medicine" is to include all branches of medicine, surgery, public health and allied sciences.

We feel assured, first, that motion picture films can and will occupy a large place in the teaching of medicine; second, that steps should be taken to stimulate the development, production, and use of proper films for purposes of medical teaching; and third, that while there are distributors and producers handling such films, there has been no definite centralization of supply or standard of reliability.

On further consideration your Committee begs to recommend the appointment by the Board of Regents of a special committee as follows: Will H. Hays, Esq., New York, Honorary President; J. Bentley Squier, M.D., New York, Chairman; W. W. Chipman, M.D., Montreal; Franklin H. Martin, M.D., Chicago; George W. Crile, M.D., Cleveland; Charles H. Mayo, M.D., Rochester; Allan Craig, M.D., Chicago; Bowman C. Crowell, M.D., Chicago; and Malcolm T. MacEachern, M.D., Chicago.

We also recommend, that among the duties of the Committee be the following:

1. To arrange and carry out a survey of the medical films now in circulation. (A list of producers and distributors of these films has already been obtained as well as a catalogue of the films handled by the various distributors. It will be more difficult to determine what films are in the hands of individual private owners, but much of this information will no doubt come to light when the movement is under way.)

2. To decide upon subjects suitable for motion picture illustration for both professional and lay use and to develop the proper production of such films.

3. To determine and develop the demand for such films by communication with universities, medical schools, public health organizations and various medical or surgical bodies throughout the country and otherwise.

4. To develop the application of medical moving pictures to the extent of using the vitaphone, phonafilm, or other method of synchronization so that the voice of the surgeon, physician, or teacher may be heard in explanation of the subject matter.

5. It may be found advisable to establish at the College of Surgeons headquarters in Chicago a bureau of information as to what films are obtainable for both lay and professional use, where such films can be obtained and whether or not

they are reliable and satisfactory for teaching purposes.

It is the opinion of the Committee that it may be found inadvisable for the American College of Surgeons to undertake the production or distribution of films or to enter in any way into the commercial field.

For the consideration of material other than that within the field of surgery, the College can secure the co-operation of representatives from other organizations in much the same way as in the standardization of hospitals.

In consideration of the need for such an effort in this respect, your Committee would suggest that definite action be undertaken immediately.

(Signed) J. Bentley Squier, Chairman; W. W. Chipman; Franklin H. Martin; John G. Clark; Allan Craig.

This report was unanimously approved by the Board of Regents.

## TRAUMATIC SURGERY

AT the meeting of the Board of Regents of the American College of Surgeons held in Montreal October 26, 1926, a report was presented by the Committee that had been appointed for consideration of the improvement of conditions in traumatic surgery. The report and recommendations of this Committee were based on the previous analytic and constructive consideration of some phases of the problem of the practice of traumatic surgery by a sub-committee which had furnished a detailed exposition of its findings and conclusions. The interest of this Committee has been the injured individual, and the keynote of this interest has been proper surgical care.

For the reasons set forth in the report, the Committee offered a minimum standard pertaining to the practice of traumatic surgery. With the hope that the adoption of this minimum standard might form a foundation on which might be based further constructive work for improvement of the practice of traumatic surgery, the Board of Regents accepted and approved the report of the Committee and ordered that its recommendations be complied with. A permanent Board on Traumatic Surgery was appointed, as is set out below.

### REPORT OF COMMITTEE

Your Committee, appointed for consideration of the improvement of conditions in traumatic surgery, begs leave to submit the following report, which is based on the findings of a committee composed of industrial surgeons and representatives of indemnity organizations:

WHEREAS, our review indicates that generally traumatic injuries have not been cared for by those better qualified in surgery, and

WHEREAS, we feel that a considerable amount of blame for this situation is due to past practices of insurance carriers, to a failure on the part of employers to co-operate, and to a disinclination on the part of the better qualified surgeons to interest themselves in this field of activity, and

WHEREAS, there is a very definite and aggressive attitude displayed by a number of doctors in soliciting this character of work by unethical advertising and other procedures which do not conform to our code of ethics, and

WHEREAS, there is a strong tendency toward a commercialization of this service, and all of these militate against the well-being of those injured in industry, and

WHEREAS, now there is a very definite trend on the part of carriers of Workmen's Compensation insurance, and of employers of large numbers to obtain more experienced surgeons and better hospital facilities, and in view of the other findings submitted herewith in the report of the Research Group of the Committee on Traumatic Surgery: Therefore be it

Recommended to the Board of Regents of the American College of Surgeons that the following minimum standard pertaining to the practice of traumatic surgery be adopted by the Board of Regents:

1. That all hospitals receiving traumatic cases for treatment be required to meet the minimum standard requirements of the American College of Surgeons.

2. That each of these hospitals shall have a Committee responsible for the supervision of traumatic surgery.

3. That a surgeon approved to treat traumatic cases shall be: (a) a graduate of scientific medicine in good standing and licensed to practice in his respective State, or Province; (b) competent in the field of traumatic surgery; (c) worthy in character and in matters of professional ethics; that in the latter connection the practice of division of fees under any guise whatever be prohibited.

4. That surgeons dealing with traumatic cases shall keep accurate and complete case records of all patients—a complete record being one which includes: immediate record of injury, detailed

description of physical findings, adequate record of treatment, a record of estimated period of disability, the end-results, when possible—and these records shall be filed so that they are available at all times for submission as shall be required.

5. That surgeons and hospitals dealing with traumatic cases shall have available adequate diagnostic and therapeutic facilities.

*And*, be it further recommended that a Board be appointed for the purpose of carrying on these studies and the making of recommendations to your Board with a view to improving the service in this field, which is of such great economic importance.

Frederic A. Besley, Chicago
John B. Walker, New York
D. Z. Dunott, Baltimore
Ernst A. Sommer, Portland
J. E. Bacon, Miami, Arizona
A. D. Lazenby, Baltimore
C. H. Fornell, New York
Bowman C. Crowell, Chicago
Alfred Stengel, Philadelphia
W. O'N. Sherman, Pittsburgh
L. H. Landry, New Orleans
E. W. Archibald, Montreal
C. H. Mayo, Rochester

In compliance with the last recommendation of this Committee, the Board of Regents appointed the following Board on Traumatic Surgery:

Frederic A. Besley, Chicago, *Chairman.*
J. E. Bacon, Miami, Arizona
R. W. Corwin, Pueblo, Colo.
Bowman C. Crowell, Chicago
Donald Guthrie, Sayre, Penna.
Lucian H. Landry, New Orleans
A. D. Lazenby, Baltimore
Charles F. Martin, Montreal
Charles H. Mayo, Rochester
Thomas G. Orr, Kansas City, Mo.
Wm. O'N. Sherman, Pittsburgh
Ernst A. Sommer, Portland
Frederick J. Tees, Montreal
Wallace I. Terry, San Francisco
John B. Walker, New York